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J. M. WAKEMAN, - - - - - - President and General Manager.

CHICAGO OFFICE, - - - - - - - - - - 1139 Monadnock Block.
PHILADELPHIA OFFICE, - - - - - - - - - 929 Chestnut Street.

EUROPEAN OFFICE, - - - - - - - - - - A. C. Shaw, Manager.
Hastings House, Norfolk St., Strand, London, England.

T. C. MARTIN AND W. D. WEAVER, - - - - - - - - - Editors.
T. R. TALTAVALL, - - - - - - - - - - - - Associate Editor.

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CONTENTS.

	PAGE
Editorial	671
Opening of the New York Electrical Society Season	674
Electrical Engineers of the Day—XVII; Harold W. Buck	674
Walla Walla, Wash., Electrical Transmission Plant	675
Gas vs. Electricity, by Alton D. Adams	676
The Zossen Polyphase Railway Installation for Experimental Trials, with Speeds up to 125 Miles an Hour—V, by Walter Reichel	678
The Theory of the Electrolytic Rectifier, by Dr. K. Norden	681
The Telephone as an Information Bureau	682
New Telephone Patents	683
Current News and Notes	684
LETTERS TO THE EDITORS:	
Wireless Telegraph Reports of the Yacht Races, by G. P. Gehring	686
Lighting at the Omaha and the Pan-American, by Luther Stieringer	686
Digest of Current Electrical Literature	687
New Books	692
The De Laval Steam Turbine	693
A Watch Demagnetizer	694
National Association of Automobile Manufacturers	695
Snap Cover Steel Conduit Moulding and Safety Switch	695
Automatic Door Switch	695
A Modern Printing Press Equipment	696
New Feed Water Heater	696
Milling Machines at Pan-American	696
The Kellogg Telephone and Switchboard Exhibit at the Pan-American	697
DEPARTMENTS:	
Financial Intelligence	699
Commercial Intelligence	700
General News	702
Trade Notes	707
Record of Electrical Patents	708

TELEPHONIC INTELLIGENCE.

In its endeavors to deal satisfactorily with the public, one of the largest independent telephone exchanges in the country, the Cuyahoga, of Cleveland, has organized a trouble and information bureau, at the head of which it has placed a young lady who has a reputation throughout the State of Ohio for the great success she has achieved in dealing with imbeciles. Probably in making this selection of Miss Ashley, the Cuyahoga Telephone Company had no intention of reflecting upon the average intelligence of the public of Cleveland, but the fact remains that a large percentage of the trouble in giving good service is due rather to the subscriber than to the system. It has been seriously suggested more than once by contributors to these columns that patrons of the telephone need to be educated in the use of the instruments; and it is amusing to note how this is resented by daily newspaper critics, who certainly never undertook to handle a bicycle or a typewriter without some preliminary drill; in fact, one of the marvels of telephonic work is the ignorance of such newspaper critics about it, as, for example, that of the man on the *New York Times* who keeps on talking editorially about the "regular subscriber with his unlimited service," after it has been laboriously and painfully explained to him time and again in these columns, and out of them, that that personage is a back number of years ago, there being now in all New York only some 1200 "unlimited" out of a total of nearly 60,000 "regular subscribers," all of at least 45,000 "paying for the exact amount of goods delivered." Possibly we may have to state that fact 50 times again, or get Miss Ashley to do it, before it is accepted in the silence that carries consent.

One marked novelty characterizes the new bureau in Cleveland, namely, the giving of information on moot points, as well as clearing out lines that are busy or in trouble. We print a brief list of the questions submitted to Miss Ashley for answer. Some of them betray a low order of intellect; others an absence of education, but it would not be fair to infer mental inferiority in Cleveland from them, any more than it would be to suppose that a newspaper is unduly dense because it "cannot get the real state of the case through its thick head," when it is stated by every telephone expert that, as in a great many other lines of work, the cost of giving service runs up as the bulk of business increases; so that the margin of profit on each transaction tends to decline. The attempt to use the telephone for other purposes than conversation is not new. Years ago, attempts were made in this country to send time over its lines, and it is still employed for fire alarm and early morning alarm purposes. At Budapest, it is part of a newspaper service, and in London the "electrophone" is said to be quite a success in connecting people with places of amusement. But the "information bureau" is something new, and should be valuable to a community thirsty for knowledge and too lazy to look it up for itself. There will be a check on sales of literature of the "Inquire Within" character, and a relief to the editors now plagued with requests for data of all kinds.

WIRELESS TELEGRAPHY.

We cannot refrain from directing attention to correspondence in this issue on the timely topic of wireless telegraphy at the recent international yacht races. The brief report which we made of the mingled success and failure of the system seems to have given umbrage in some quarters. While we cannot change the fact and record a complete success, we regard the work done as encouraging. The

fact remains, however, that the moment interference of rival signaling was set up, nothing could be done. This was true of the attempts at the races two years ago, and would imply that selective wireless telegraphy is still a thing of the future. Evidently, it was not feasible to send two messages at once, and it was evidently not less foolish to repeat the same news a minute after it had already gone in over some other etheric service. In brief, etheric telegraphy stands to-day a worse "monopoly" than anything else in the electric line, for whoever "does the trick" must have sole use of air, earth and sea.

URBAN AND SUBURBAN ROADS.

One of the most interesting features of the Street Railway Convention was the paper on and subsequent discussion of this most timely topic. The interurban road to-day is in a somewhat indeterminate position. It has in a measure outgrown its early association, and has not yet found a definite place in what one may call the major tactics of general transportation. It is steadily differentiating itself from purely urban traction, and is approximating, while it has not yet reached, the field of ordinary railway practice. The vital present question is this: How far can electric interurban service assume the functions of general railway service without incurring its inhibitions? Ordinary railways have to run over their own rights of way with well defined restrictions as to crossings and relations with other roads; they have to find unobjectionable stations or termini in the cities which they serve, and they stop for passengers and freight at rather long intervals. They are subject to sharp legal restrictions as to equipment and service, and come in their interstate relations under the control of the general government. Interurban roads for the most part have grown out of the necessities of urban service, and in the majority of instances operate wholly or in part over public streets and roads, with few express or implied limitations as to speed and no or few restrictions as to crossings. Originally they stopped on signal for passengers, or at short intervals, and furnished a part of the urban local service. These conditions have steadily been changing, and we now have admirable interurban lines running heavy cars at ordinary railway speeds, carrying both passengers and freight and having well defined stations. It is a small wonder that their relations to urban tramway systems have become somewhat confusing.

During the discussion, Mr. Crosby called attention most forcibly to the physical difference of equipment between these two classes of roads, and the inherent difficulties of coming to a common basis. The modern interurban car may be 50 ft. long and weigh 30 tons, while its running gear differs little from that of an ordinary steam passenger coach in dimensions and weight. Its normal economical speed may be 20 or even 30 miles per hour. Such a car calls up rather serious questions when it arrives at a city line. It is on the one hand physically unfitted for convenient operation under tramway conditions, and on the other hand it is a grave inconvenience to compel the passengers to change cars, and to tranship or distribute freight at that point. When the interurban cars are of a character more closely allied to the urban cars the solution of the difficulty is readily found in traffic arrangements that will give the outside line a terminus in the heart of the city, as is really necessary for the convenience of the passengers. But the limiting case arises with inconvenient frequency, and there is trouble ahead. Mr. Crosby leans strongly to a complete separation of service with a change of cars at the termini of the interurban road. This, however, is bad in point of convenience, as bad as it would be if the N. Y., N. H. & H. between New York and Boston had one terminus at Port Chester and the other at Readville, with surface cars the rest of the way. If not over surface lines, then over underground or elevated trucks, the cars should come to a convenient terminus. There is certainly a line between an interurban electric tramway and an electrically operated railway connecting two cities, albeit it may seem at first thought as shadowy as the distinction between chicken and fowl. When interurban cars by weight, dimensions and speed become physically unfitted for operation in the streets of a city, the system which operates them has definitively passed out of the tramway class. Nor could the New York Central properly be considered anything but what it is, even if the roadbed were capable of taking the Empire State Express clear down to the Battery. There is a distinction between the things in themselves which should be defined before there is further confusion.

ELECTRICITY VS. GAS.

The discussion of the relative growth of gas and electric service during the last decade by Mr. A. D. Adams in our columns this week opens a number of interesting questions as to the future. As to the past the issue is clear, for what is true in Massachusetts is *a fortiori* true in most of the other States. For the gas industry was as firmly intrenched physically and legally in that Commonwealth as anywhere in the country, yet by 1892 the bottom had been knocked out of the gas street-lighting business and the sales of electrical energy had risen to nearly $3,000,000 per year. But, as has many times been remarked, the advent of electric lighting actually served as a stimulus to the sale of gas. For example, from 1891 to 1892 the increase in gas sales was absolutely, although not relatively, larger than the gains in the sales of electricity, in spite of the fact that a considerable amount of street lighting had passed from the former to the latter. The same is true of the years 1894 and 1895, although these years of stress were years of relative depression in the gas industry, and again nearly in 1899 and 1900. Of course, the introduction of so brilliant an illuminant as electricity had the effect of putting general illumination at a higher pitch, and as gas, so far as mere candle-power is concerned, is usually cheaper than electricity, it, of course, got a material share of the increase. The very recent increase in gas sales is, however, probably due to the increasing use of gas stoves and of mantle burners. It would be interesting to trace the effect of both gas and electricity on the sales of kerosene, which we fancy has held its own pretty well. In other words, the sale of illuminants per capita has very greatly increased in the last ten years, both in public and private lighting.

Mr. Adams' figures give some interesting data on this point. In 1890 the total sales for public and private purposes were $6,668,731, while in 1900 they had risen to $12,155,676, though the population had only increased 25.2 per cent. A large part of this increase is in private lighting, for while in 1890 the total sales of gas and electricity were $1,104,424, in 1900 they were $1,847,448. So much for the stimulus given to artificial illumination by the introduction of electric lighting. If the result were reduced to candle-hours it would be still more striking, for in the last ten years the prices of both gas and electricity have fallen to a considerable degree. It is probably well within the truth to say that in the last ten years the consumption of illuminants per capita has more than doubled. As to the future, we think the experience of the past will be repeated. The oft-repeated prophecy that electricity would drive gas from the field is far from its fulfillment. In point of fact, gas seems intrinsically able to hold its own in the general market, and the effect of the electric competition at present is confined to limiting and defining the field of gas. In street lighting gas is likely to play year by year a less important part and may eventually become a negligible quantity. In general lighting, on the other hand, unless there are very great advances in the electrical art, gas is from an economic standpoint amply able to hold its own. Electricity will steadily make inroads on gas for general lighting, but if we mistake not for every dollar the latter loses it can

gain one as fuel. This is a field in which gas has not yet risen to its logical place. As electrical competition gets stiffer the price of gas will fall, and it has a long way to fall before it reaches bottom, until it can reach the domestic fuel market effectively. From that last stronghold it is not likely to be driven by any form of electric competition yet devised.

The competition of electricity with gas has assumed even a more acute stage in England than in this country, if we are to judge from a recent editorial in the British *Journal of Gas Lighting*, printed under the title "A Grave Situation." After referring to its own efforts in combating electricity by exhibiting its "seamy side," the confession is made that "although there are no fresh electric lighting companies of the old pattern started, those that are actually in the business hang on, and the disappointment of local authorities who have electric lighting undertakings does not prevent others following in their track." Gas investments, it says, are not held in the estimation they should command, primarily because electric lighting has made inroads upon the preserves of some big undertakings. "On the other hand, gas has not yet in a single instance definitely stopped the career of an electric lighting undertaking. The latter continue to grow; and although their capital grows also, and their state is not usually prosperous, still they often appear to hurt gas if they do not benefit themselves." The gravity of the situation is further emphasized by the fact that our British gas contemporary can suggest no broad line of defence against electrical competition, contenting itself by severely scolding gas company officials for indolence and neglect of duty.

The Voltaic Arc as a Telephone Transmitter.

A paper has recently been read before the International Society of Electricians in Paris on experiments with the voltaic arc as a transmitter. This subject is not only interesting from a technical standpoint, but it also offers hope to experimenters from a practical point of view. Very little improvement has been made in the carbon telephone transmitter since its first development in the hands of inventors some twenty years ago. It would seem that the possibilities of the carbon transmitter have been nearly exhausted. The energy of the electrical waves transmitted over a telephone circuit is only a fraction of the energy of the waves in the primary circuit of the transmitter, and this in turn is only a small fraction of the energy of the current supplied by the voltaic cell in the transmitter local circuit. If it were not for the marvelous sensibility of the receiving telephone, the carbon transmitter would remain an interesting scientific toy.

It is evident that it would not be practical to have a voltaic arc burning on the table of each person using the telephone, but if a voltaic arc transmitter possessed very great power, as compared with the ordinary carbon transmitter, it might be quite possible to employ the arc transmitter on special occasions, such as when a public speaker was addressing an audience, in order that his voice might be heard by telephone at a number of distant points. It ought to be possible to force a telephone to shout, when necessary, as loudly as does the gramophone, or even the megaphone or steam siren. The siren voice would probably be required very rarely, but the possibility of speaking in siren tones would be at least potentially valuable, and might be worth utilizing for occasional purposes, even at considerable trouble and expense in the transmitter. It would be necessary to liberate a relatively large amount of energy in the transmitter circuit, and to allow the relatively feeble energy of the vocal sound waves to modify and control the transmitter circuit energy in a very sensitive rhythmical manner. Every improvement in the power of the transmitting apparatus, and in the range of effective transmitting e. m. f., increases the range of telephonic transmission, or enables a smaller telephonic wire to be employed for the same range of telephonic transmission. While the experiments thus far described have not been very successful, yet it is to be hoped that more encouraging results are yet to come.

The Aluminum Electrolytic Rectifier.

Much interest has been recently directed to the aluminum rectifier. It is well known that if a plate of aluminum is substituted for one of the plates of lead in an ordinary storage cell, the apparatus so modified, will readily let current pass when the aluminum plate is a cathode, but will interpose a marked barrier itno the circuit when the aluminum plate is an anode. Consequently the apparatus forms a sort of artificial valve or filter for unidirectional currents when connected with the alternating-current circuit. Unfortunately, the efficiency of the cell has been found too defective hitherto to permit of its practical application; otherwise, it is quite possible that a battery of such cells might take the place of the converter.

Dr. Norden's article appearing in this issue throws light upon the nature of the actions which occur in the cell. It is shown that the action is not to introduce a unidirectional c. e. m. f., which would have to attain a magnitude of as much as 100 volts, but is to introduce a selective resistance residing in a very thin film of hydroxide formed upon the plate. This film is virtually an insulator, and seals up at each impulse of current leaving the plate for the electrolyte, but breaks down and becomes electrically pervious at each opposite impulse of current leaving the electrolyte for the plate. According to this theory, there should be an intermediate stage at each cycle of current, in which a very considerable resistance should be offered to the rising current strength in the favored direction, and during which interval a relatively considerable loss of energy should be developed as heat in the film. In other words, the door is not alternately shut closely and opened widely, but commences to open more or less gradually with objectionable intermediate resistance, corresponding to the wire-drawing of a valve in a steam engine. This may account for the inherently considerable losses of energy which have been hitherto encountered in the tentative use of this electrolytic rectifier.

It would be interesting to determine whether the very thin film of insulating material, which Dr. Norden says is the hydroxide of the metal, is similar in its properties to the oxide which forms in air with such great rapidity upon the surface of a freshly scraped aluminum plate. It is alleged that if this thin superficial coating of an oxide did not form upon a freshly exposed surface of the metal, the affinity between aluminum and oxygen is so great as to cause complete combustion to be started at ordinary temperatures. In fact, it is said that we never see pure aluminum, but always view the metal through a thin veil or film of oxide, and that the difficulty in soldering pieces of aluminum lies in the difficulty of dislodging this thin protective layer, and of bringing the two metallic surfaces into intimate contact in air without the reformation of a separating film.

According to the theory laid down, it would be reasonable to expect that the efficiency and effectiveness of the aluminum rectifier would be greater for low alternating frequencies than for high frequencies, other conditions remaining unchanged, and evidence upon this question would be of much interest. In fact, it would appear from some experiments of Professor Wilson that beyond a certain frequency, the formation of the film is not sufficiently complete to produce any practical rectifying effect.

Opening of the New York Electrical Society Season.

The 217th meeting of the society will be held at the College of the City of New York, corner of Lexington Avenue and Twenty-third Street, Wednesday, Oct. 30, at 8 p. m. Mr. F. W. Willcox, of the Edison Lamp Works of the General Electric Company, at Harrison, N. J., will deliver a lecture on "The Manufacture and Use of the Modern Incandescent Lamp." Mr. Willcox's lecture will be a review of one of the largest branches of the electrical industry, and will take up the subject of lamp manufacture, exemplifying the progressive changes which have been made in perfecting the lamp and in lowering its cost to the public. The various steps of the production of the lamp will be elaborately illustrated with slides. Mr. Willcox will also treat upon the uses of the lamp and discuss the part which it plays in the illumination of the present day, as well as various economic features of efficiency, life, etc.

As an appropriate supplement to this lecture, Mr. Luther Stieringer, consulting electrical engineer of the Pan-American Exposition, has kindly consented to deliver a brief address on "The Incandescent Lamp at the Pan-American Exposition." The magnificence and beauty of the night spectacle at the Exposition has excited the admiration of the world. Mr. Stieringer will describe how these effects were obtained solely with the aid of the incandescent lamp, and will outline the principles to be observed in the employment of light for artistic effects. Secretary Guy announces that ladies will be welcomed at this meeting.

American Railroad Data.

The advance sheets of *Poor's Manual* shows an increase in the railroad mileage of the United States for the fiscal year of 1900 of 4160 miles. The total mileage was 191,861 miles, and the total revenue from traffic aggregated $1,501,695,378. Operating expenses were $1,018,447,852, and net earnings were $483,247,546. The total available revenue was $551,020,469, and from this sum there was deducted for interest, rentals, dividends and similar purposes $458,460,571, leaving a surplus over all charges and miscellaneous payments of $92,559,889. The total assets of all railroads were $12,768,910,837. The stock capitalization was $5,804,346,250, and the bonded indebtedness $5,758,592,754. The stock, bonds and unfunded debt representing approximately cost of road and equipment, was $61,884 per mile. The average gross earnings per mile were $7,826, and net earnings $2,519. The average interest paid on the bonded debt was 4.24 per cent and the dividends paid on the combined capitalization aggregated 2.42 per cent.

Electrical Engineers of the Day—XVII.

HAROLD W. BUCK.

Harold Winthrop Buck, who now holds the position of electrical engineer of the Niagara Falls Power Company and its allied corporations, was born May 7, 1873, and is probably the youngest man in the electrical profession who has attained a position of such importance. His father is a distinguished surgeon and he is a grandson through his mother of Abbott, the well-known historian. During his brief career, Mr. Buck has, however, earned for himself exceptional opportunities for experience in the most important electrical work, and by thoroughness, courage and tact has gained the entire confidence of his associates.

Mr. Buck has always been a great lover of hardy outdoor sports, and by the exercise of such tastes has built up a rugged frame and sound nerves, which have helped him to bear the strains of study and hard work, but have not deprived him of the enthusiastic interest which is necessary to successful study or work. Mr. Buck graduated from Yale University in 1894 and afterward took a post-graduate course at the Columbia School of Mines, receiving the degree of E. E. from Columbia in 1895.

Soon after leaving college he entered the employ of the General Electric Company, beginning work as a student in the Schenectady works. He very soon began to attract attention through a display of originality and inventivenes in connection with various matters. He devised a three-phase motor operating by static induction and explained its analogy to the induction motor. The device has never been put to any practical use, but it is entirely original and interesting from a scientific standpoint.

The motor is similar in construction to the electromagnetic induction motor except that electrostatic poles are substituted in the field for electromagnetic ones. The armature consists of a continuous cylinder of any high insulating material. When the motor field terminals are connected to any high-voltage, three-phase circuit, the armature rotates nearly at a synchronous speed, the torque being produced by the lag in the lines of polarization in the insulating material of the armature, behind the rotating lines of electrostatic force.

During the first two years of Mr. Buck's work at Schenectady he suggested a number of mechanical and electrical devices and took out several patents. During this time he did some work on electrical furnaces and with two associates devised and patented a process for making corundum in an electrical furnace. This process has been developed to a state of commercial soundness, and a plant is now being built at Niagara Falls which will manufacture 5000 tons a year of the finest corundum by this method and under the patents above mentioned.

During the latter part of Mr. Buck's service with the General Electric Company he acted as one of the assistants to the engineer of the lighting department, and in that position he had a variety of experience in connection with the development of new work in the

factory, and more particularly in connection with the starting and adjustment of many very important and novel installations which were made at that time. Serious problems arose in some of these installations calling for exhaustive and laborious experimenting in large operating plants in distant cities. Such work has to be done at all hours and under the most trying conditions. It can only be done successfully by a resourceful man who has tact and can inspire the confidence and obtain the support and assistance of the men who are responsible for the operation of the stations. Mr. Buck did this work with marked ability and success, with perfect loyalty to his superior and adhesion to his instructions combined with much independence and originality.

In September, 1900, Mr. Buck was appointed electrical engineer of the Niagara Falls Power Company, the Cataract Power & Conduit Company, of Buffalo; the Tonawanda Power Company and the Canadian Niagara Power Compny. Among his many duties in this position he has drawn the specifications and directed the selection of apparatus for the new power house now building at Niagara Falls, and also the large development which is now being made on the Canadian side.

Mr. Buck has always worked with good standards in view and has intelligently sought usefulness in all branches of his profession. He has acquired a sound theoretical knowledge and has learned how to handle machinery freely and with confidence. With his equipment and the start he has made and with the immense opportunities which electrical developments now produce Mr. Buck's career ought to be a useful one.

Mr. Buck is a member of the American Institute of Electrical Engineers.

Walla Walla, Wash., Electrical Transmission Plant.

IN the spring of the present year the Walla Walla (Wash.) Gas & Electric Company completed a water power plant for the supply of electric current to Walla Walla. The plant is located on Mill Creek, about five miles from the city of Walla Walla, and is interesting from the fact that it employs the monocyclic system, and a rotary engine in its auxiliary steam equipment.

Mill Creek takes its rise in the Blue Mountains, in the State of Washington, not far from the Oregon line, and drains an area of many square miles, but on account of the denuded state of the watershed, the Creek is subject to rapid fluctuations. The average flow of water during the extreme dry season is 2800 cubic feet, but during the winter months the average is much higher.

The water is taken from the Creek at a point 5600 feet above the plant, where a concrete dam spans the stream and raises the water but a few feet above its natural bed, owing to the extraordinary fluctuations and locality. The water is conveyed to the plant through a 4-ft. stave pipe built of red wood, this giving an actual head at the power house of 82 ft. 6 inches. The pipe is buried the entire distance from the dam to the power house. It has been in use for seven years, and shows very small depreciation. The power house is built over a brick and concrete arch that spans the tail race and draft tube, which latter is 17 ft. 6 inches in length, and gives a vacuum of 20 inches.

The building is of brick 40 ft. by 40 ft., with truss roof. The floor is of concrete. At present the plant consists of one 450-hp McCormick turbine, built by the S. Morgan Smith Company, of York, Pa. The wheel is direct connected to a 300-kw General Electric revolving field monocyclic generator of 6600 volts, running at speed of 450 r. p. m. and giving a frequency of 60 cycles. The exciter is a 7½-kw multipolar machine driven from generator shaft. A 400-hp rotary engine of the Thomas & Brumagin type, is installed, and is the first of its kind of this size put on the market. The engine, which runs at 200 r. p. m., is belted to the generator shaft, which is provided with a Hill clutch, so that the generator can be handled either by water or steam, or both, as the occasion may demand.

The switchboard is of blue Vermont marble, fitted with both potential and current transformers, together with current, potential and exciting-current indicators, a three-phase electrostatic ground detector and oil switches for operating the high-potential current. The fuses are of the spring expulsion type. The line is protected from lightning by Wirt arresters enclosed in iron boxes and connected with ground wire. A good ground was made by digging in the earth down to wet gravel and bedding a coil of wire in powdered coke.

The transmission line from the power house to the city of Walla Walla, five miles distant, consists of cedar poles 35 ft. long with 8-inch tops. The pole line is designed to carry two circuits of three wires each, but at present there is only one circuit. The poles are placed 100 ft. apart and carry two No. 2-0 and one No. 8 hard-drawn copper wires.

The sub-station is provided with one 75-light and one 25-light series constant-current transformers, oil cooled. Two 100-kw single-phase and two 50-kw "Teaser" transformers are connected by means of a cross connection on both primary and secondary sides, and step from 6600 to 2080 volts pressure. The sub-station is provided with a skeleton switchboard upon which are mounted current and potential indicators for the incandescent lighting and power load of two circuits. The constant-current circuits are each provided with current transformers and ammeters, and tubular plug switches on both primary and secondary currents.

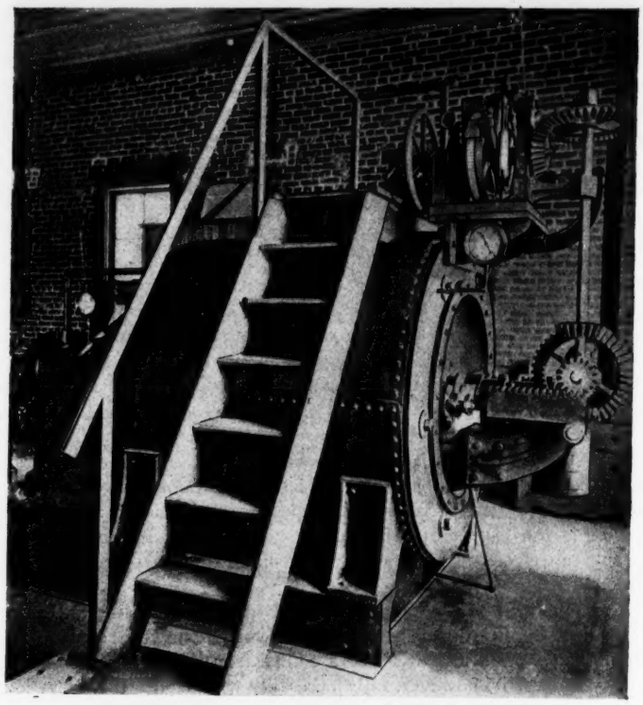


FIG. 2.—350-HP TURBINE.

The sub-station is protected from lightning in the same manner as the power house, and also with an oil switch, which will disconnect the entire sub-station from the primary lines. The secondary lines

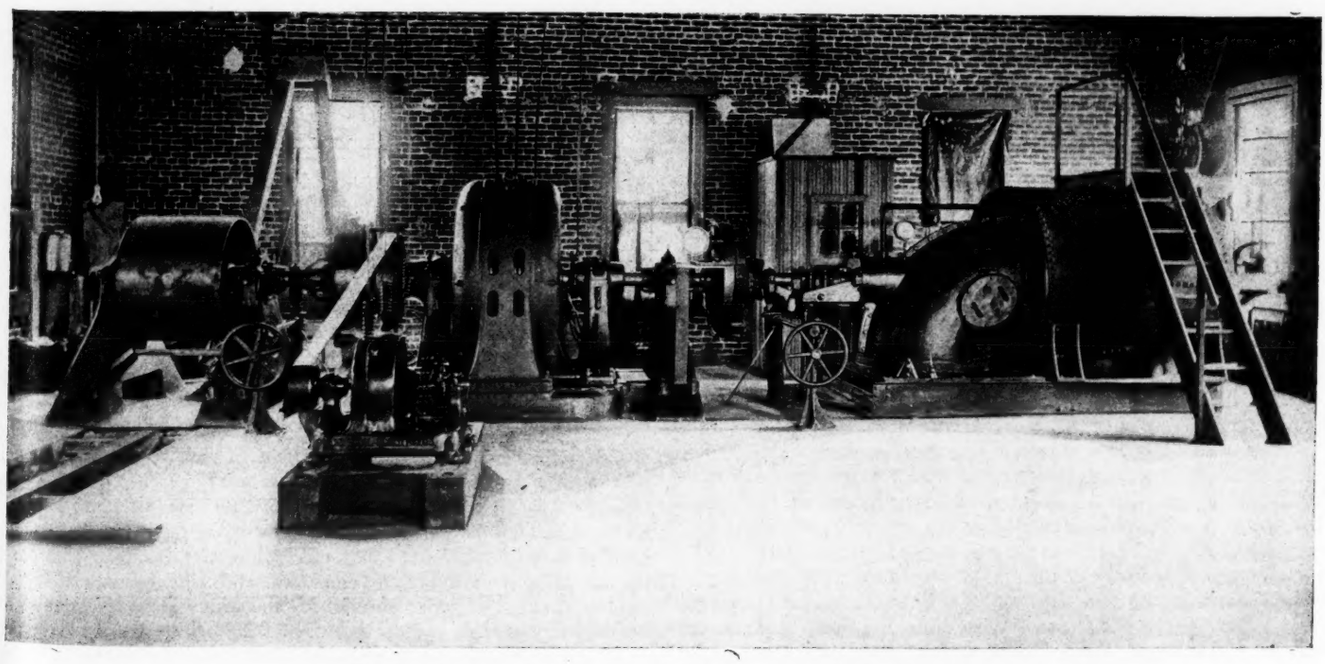


FIG. 1.—INTERIOR VIEW OF WALLA WALLA WATER POWER PLANT.

are equally well protected from lightning., The distribution of all secondary circuits is by the two and three-wire systems.

The Walla Walla Company also owns the gas works and distributes 6,000,000 ft. of gas per year. The patrons served by this company are well satisfied with the electrical service they receive. Mr. H. Wadsworth, of San Francisco, is president, and Mr. C. E. Burrows, of Walla Walla, is general manager. The plans for this plant were drawn by Mr. D. L. Huntington, C. E., of Spokane, Wash. The development was commenced in October of 1900, and carried out under the supervision of E. C. Morrow, superintendent of the electric department. The plant was put in operation in May, 1901, and has been in operation since that time without a single shut down or accident to mar the good service.

Gas Versus Electricity.

By Alton D. Adams.

GAS and electric systems are competitors in general distribution for light, heat and power. A comparison of the incomes of these systems, on a large scale, is therefore of interest. Such a comparison may well be conducted on two distinct lines. First, to determine the changes in amount of the incomes of each system through the same series of years, and, second, to show the relative incomes of both systems through these years. The most important division to be made in the earnings of gas and electric plants is that between the incomes from public and private service. Public service usually takes the form of street lighting, and private service is the supply of individual consumers. It is thus desirable to separate from gas and electric incomes the parts received for street lighting.

The supply of gas through pipes laid in the public streets was on a business footing during some decades before the electric lamp was other than a scientific toy. For a comparison between gas and electric systems it is, however, only necessary to consider the operations of the former since electrical supply became a commercial factor. Some small beginnings, in the way of electric lighting stations, were made prior to 1880, but it is not possible here to present any comprehensive view of the earnings of either gas or electric systems at that early date.

The State of Massachusetts is selected as the field for the present comparison, because its public records of the operations of gas and electric plants are more complete than those in any other State. Moreover, both these classes of plants have been developed on a great scale in Massachusetts, from its many small towns to its one great city. From the public records of this State, the incomes of all its gas systems have been determined, for the years between the middle of 1885 and 1900. For all the electric lighting stations, records go back only to the years since the middle of 1889, and their incomes are given accordingly:

Incomes of all gas and electric systems engaged in general distribution in Massachusetts.

Year ending June 30.	Gas sold by meter.	Gas sold for public lamps.	All sales electrical energy.	Sales for electric street lamps.
1886	$3,678,206.06	$433,063.02		
1887	3,789,643.30	421,430.65		
1888	3,900,416.07	396,876.29		
1889	4,027,049.67	352,934.84		
1890	4,432,899.30	327,438.05	$1,908,394.00	$776,986.18
1891	5,040,438.78	292,544.62	2,432,869.15	
1892	5,308,118.06	262,777.00	2,947,199.64	
1893	5,439,302.81	262,309.09	3,427,576.84	
1894	4,500,605.49	211,727.83	3,623,056.92	
1895	4,779,821.60	187,874.48	3,794,060.41	
1896	5,517,061.62	181,006.85	4,148,681.71	1,422,020.76
1897	5,514,936.64	179,664.22	4,467,147.10	1,471,689.18
1898	5,669,060.07	182,662.56	4,775,316.07	1,567,379.97
1899	5,800,667.63	182,278.82	5,046,412.75	1,599,277.62
1900	6,357,368.00	175,752.26	5,622,556.43	1,671,696.13

Though figures cannot be given for the incomes of electric systems prior to the date named, the changes in the incomes of gas plants show that the competition of the former was an important factor after the middle of 1885. Incomes of gas systems are given for sales by meter, and for sales to public or street lamps, these two must be added to determine total incomes from gas sales. Other minor sources of income to gas and electric systems, such as the rental of stoves, are not considered here. The year ending at the middle of 1890, shows a gain of 20 per cent in the income from sales of gas by meter, over the year ending at the middle of 1886. During this same period the income from sales for public gas lamps declined 24 per cent. This reduction of gas income must have been due to electric street lighting, which was increasing rapidly at the time, and is the only known cause that could have produced the result.

From the middle of 1889 figures are given for total sales of electrical energy, of which the income from street lighting forms a part. The income from electric street lighting is given for the year ending June 30, 1890, but it is not possible to present it for other years before that ending at the middle of 1896.

As the record of incomes for both gas and electric systems is complete for the year ending June 30, 1890, a comparison of these systems is made to begin with that year. The income during the year last named from each class of service by gas and electric systems is taken as 100 per cent, and the number representing this income is used to divide the like income of each following year. In this way the per cent which the income of each class bears to the like income for the year ending at the middle of 1890 is determined.

To better illustrate the changes that have taken place in the four incomes, curves Nos. 1, 2, 3 and 4 are drawn. Each curve starts at 100 per cent for the year ending at the middle of 1890, and conforms to the corresponding per cent for the following years. Curve 1 represents the relative amounts of incomes from all sales of electrical energy during the 10 years named. The constantly upward course of this curve indicates an uninterrupted increase of electrical income.

Ratio of income for each year to the income for the year ending June 30, 1890.

Year ending June 30.	Income all gas sales.	Income gas street lamps.	Income all electric. energy.	Income electric street lamps.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
1890	100	100	100	100
1891	112.2	89.3	127.4	
1892	117.2	80.2	154.4	
1893	119.7	80.1	179.6	
1894	98.9	64.6	189.7	
1895	104.3	57.3	198.0	
1896	119.6	55.2	217.3	183.0
1897	119.5	54.8	234.7	189.4
1898	122.8	55.7	250.2	201.7
1899	125.5	55.6	264.4	205.8
1900	137.2	53.6	294.6	215.1

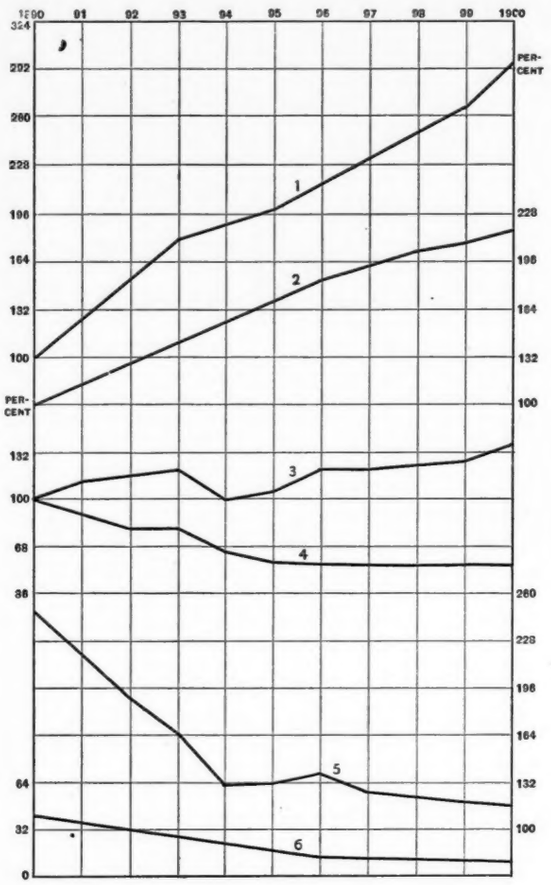
During the 10 years represented by the curve, the yearly income increased 194.6 per cent beyond that of 1890. This growth nearly equals 20 per cent a year for the entire period, or an addition to the income of an amount corresponding to the income of 1890, every five years.

Curve 2, drawn to the same scale as curve 1, represents the per cent of increase in income from electric street lighting during the period. Like the curve of total income, that for electric street lighting shows a steady ascent from the middle of 1890 to the like date in 1900. As may be seen from the table, no data is available for the income from electric street lighting between 1890 and 1896. The income for the year ending at the middle of 1890 is taken at 100 per cent as in the previous case, and the relative incomes of the years ending at the like date in 1896 and thereafter are calculatd accordingly. For 1896 the income from electric street lighting was 183 per cent of that in 1890, and from this point on the rate of increase, though not quite so rapid as before, was sufficient to reach 215.1 per cent in 1900. The added income for the last year over the first of the period was thus 115.1 per cent, and the yearly average 11.5 per cent, or a little more than one-half of the annual per cent of gain for the entire electric income.

Curves 3 and 4 for the gas incomes are drawn to the same scale as those just described, and therefore indicate at a glance the general tendency of these incomes compared with the two former. The movement of the total gas income is indicated by curve 3. This curve shows an increase of receipts up to the middle of 1893, but here comes a decline for the dull period after the panic of 1893, and

the loss is not regained until 1896. The effects of industrial depression during this same period are shown by the changed direction of curve 1 from the middle of 1893 to the middle of 1895. Electrical income, however, did not decline, but only slackened in its upward movement. Gas income, on the other hand, went back for the year ending June 30, 1894, to 98.9 per cent of what it was for 1890. Since 1897 there has been a moderate yearly increase in the volume of gas business, and at the middle of 1900 the yearly income stood at 137.2 per cent of what it was for 1890.

This increase of 37.2 per cent during 10 years corresponds to 3.7 per cent each year, on an average, or less than one-fifth of the like average for the total electric income. Unlike either of the curves just considered, curve 4, illustrating the changes in income from gas street lamps, takes a downward course from the start, indicating an almost constant though not uniform decline in the amount of yearly income. Most of this decrease took place before the middle of 1895, the annual income for gas street lamps at the middle of that year



CURVES ILLUSTRATING CHANGES IN INCOMES.

being only 57.3 per cent of the amount for the year ending in 1890. Since 1895 gas street lamps have yielded a nearly constant income yearly, the amount for 1900 being 53.6 per cent of that for the first year of the period.

The corresponding decline of 46.4 per cent in the receipts from gas street lamps amounts to an annual average of 4.6 per cent during the 10 years. This figure is in striking contrast with the yearly gain of 11.5 per cent noted for the incomes from electric street lamps.

Thus far gas and electric incomes have been considered only as to the changes of each from year to year. The accompanying table, with curves 5 and 6, illustrate the relative amounts of incomes derived from gas and electric service, both as to the totals and as to that portion received for street lighting. Curve 5 shows the per cent of total gas income to total electric income for each year between the middle of 1890 and the like date of 1900.

For the year ending June 30, 1890, the entire income from the sale of gas was 249.9 per cent of the entire income from sales of electrical energy in the same year. From the date just named to the middle of 1894 there was a nearly uniform fall in the ratio of gas to electric incomes of 29.8 per cent yearly on an average, or 119.3 per cent for the four years. Between the middle of 1894 and the like date in 1896 the ratio of gas to electric income rose 6.7 per cent, standing at 137.3 per cent for the latter year. During the next four years the curve shows a further decline in the gas income to 116.1 per cent of the electric in 1900. The net result of these movements is a total fall in the ratio of the gas to electric incomes of 133.8 per cent, or 13.3 per cent yearly on an average.

In other words, the income from all sales of gas was 2.5 times the like electric income in 1890, but in 1900 the earnings from gas were

Ratio of incomes from sales of gas and electrical energy in each year.

Year ending June 30.	Total gas income as per cent of total electric income.	Income from gas street lamps as per cent of income from electric street lamps.
1890	249.9	42.1
1891	219.2	
1892	189.0	
1893	166.3	
1894	130.6	
1895	130.9	
1896	137.3	12.7
1897	125.2	12.2
1898	122.5	11.6
1899	118.5	11.3
1900	116.1	10.5

only 1.16 times those from electrical energy. Curve 6 illustrates the ratio of income from gas street lamps to income from electric street lamps for each year from 1890 to 1900. Unlike the income from total sales of gas, that from gas street lamps began the period in question much below the corresponding electric income. For the year ending at the middle of 1890 the income from gas street lamps was only 42.1 per cent of the receipts for electric street lighting. No other figures for electric street lamps are available until 1896, when the ratio of gas to electric income from street lamps had fallen to 12.7 per cent. This is at the rate of nearly 5 per cent yearly. Since 1896 the decline of the ratio for gas has been much more gradual, the figure for 1900 being 10.5 per cent of the earnings of electric street lamps. For the entire period of 10 years the gas income from street lamps lost 31.6 per cent compared with the electric, or more than 3 per cent yearly on an average.

Looking at the six curves, it may be seen that the first field of serious competition between gas and electrical energy was that of street lighting. The unrecorded rise of electric lamps to the commanding position in this field must have taken place in the decade from 1880 to 1890, for in the latter year the electrical was more than douple the gas income from street lamps. This struggle continued with somewhat less vigor until 1896, when the income from gas was only one-eighth of that from electrical street lamps. Since this last date gas has slowly moved toward a position of even less relative importance in street lighting. Not content with its conquest in the field of public service, electrical energy is rapidly moving toward the position of first importance in the supply of private consumers. This tendency is operating with renewed vigor since 1896, as may be seen by inspection of curve 5 since that year.

It may be thought that the falling ratio of gas to electric income is due entirely to the rapid rise of earnings with electrical energy, as illustrated in curve 1, but it seems certain that the change of this ratio is due in part to a smaller use of gas for illuminating purposes per unit of population. The number of inhabitants in Massachusetts increased 25.2 per cent during the decade from 1890 to 1900. During this same period the total income from sales of gas increased only 37.2 per cent. Meantime the number of gas stoves in use has increased several hundred per cent, and the number of gas engines by a large per cent.

To supply these stoves and engines it seems certain that much more than the gas represented by the 12 per cent increase of income over the increase of population must have been necessary.

It follows that the amount of gas income per capita, from its use for illumination, and probably the actual volume of gas per capita is now less than it was in 1890.

The foregoing facts point to the conclusion that electrical energy

is forcing gas from its former leading position in the field of artificial illumination, and to its more rational use for heating and the production of power in units of fairly large capacity.

For the distribution of power in small units, say, under 20 horsepower, gas engines have been hopelessly distanced by electric motors, as general observation amply proves.

The Zossen Polyphase Railway Installation for Experimental Trials with Speeds Up to 125 Miles an Hour.—V.

By Walter Reichel.
(Chief Engineer Siemens & Halske Company.)

HIGH-TENSION SWITCHES.

THESE switches, like those for the mean pressure circuits, are built on the tube principle, and have a double break on each of the three branches. They differ materially from the mean pressure type in that the contacts are not arranged in a circle, but in sets of three, and that one-half of the switch is above and the other half below the roof of the car. For this purpose the same type of hollow insulators, as those for the high-tension fuse device, is used. The current passes from the current collector (trolley) through these hollow insulators to the one contact piece; from this through a bridge to the other contact of the switch and then through the second hollow insulator back to the roof and then through the distributing circuits to the safety fuses.

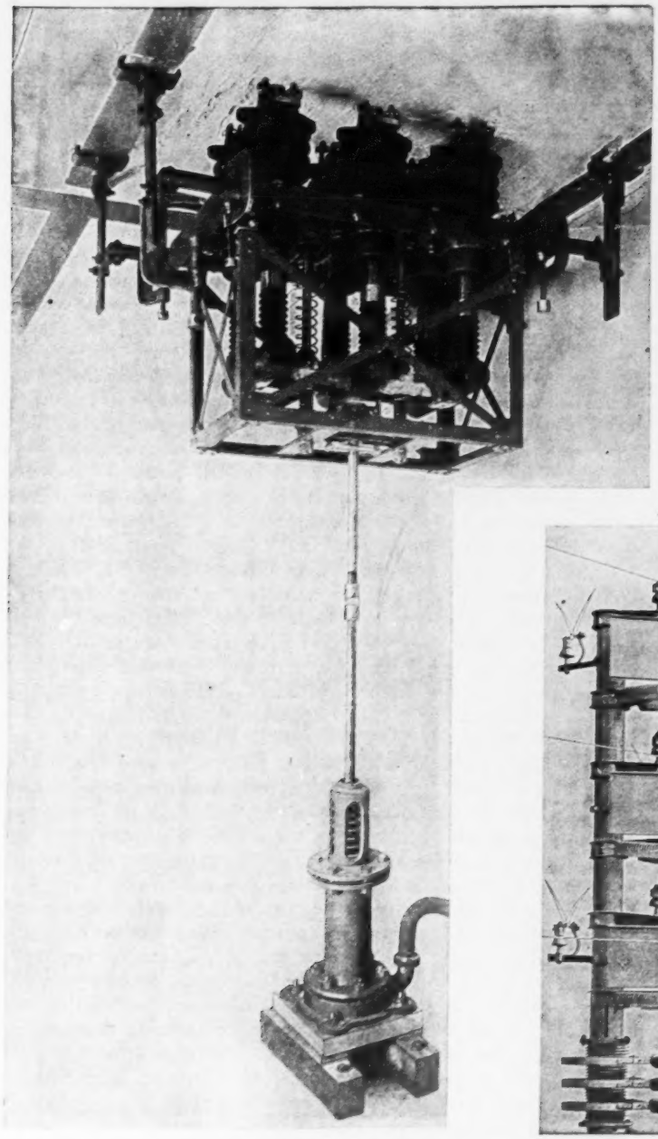


FIG. 25.—HIGH-TENSION SWITCH WITH COMPRESSED AIR MECHANISM.

The switch is located in a sheet iron box next to the small transformer. To the cover of this box are fastened six insulators above referred to, two for each branch. The main contact consists of a ring, into which fits a split copper tube. An auxiliary contact consists of three horizontal circular segments of copper into which a plunger is pushed.

The split copper tube of the main contact and the plunger of the auxiliary contact are connected together. The above-mentioned bridge consists of a U-shaped hollow cast body, which is covered without and within by hard rubber, and through this passes the connecting wire for the two legs of the circuits.

The three bridges of the three branches are joined by a plate (Fig. 25), and are operated by a common compressed air cylinder, having a stroke of 10 inches, which is located toward the front of the car beneath the seats. The plate is guided by two vertical rods and the switch is closed by the plate being raised by the cylinder piston.

As in the mean pressure switch, two snap hooks hold the plate tightly after it has been pushed into place, and the plate can only be released by springs after the piston, having returned to its original position, has released the hooks. The lowering is therefore very rapid and assures the breaking of the sparks. The lift of the bridges is limited by buffer springs.

CURRENT COLLECTOR OR TROLLEY.

The current collectors, through which the current passes from the line to the high-pressure switches, are widely different from any type heretofore constructed. They are patterned after those used on the Siemens-Halske Lichterfelde experimental line. As it was deemed inadvisable to permit crossings over high-speed railways on account of the fact that the wires might possibly be touched from the bridges and because such crossings would necessitate a lowering of the current collectors which at such high speeds is not to be recommended, it was decided that the high-speed railway must always pass over other highways, even if the roadbed must be raised accordingly. This gave the designers unlimited space above the roof of the car, and admitted a design which would be efficient and certain. It consists of a heavy mast built into the car, which is movable about its vertical axis. The mast consists of two telescoped Mannesmann tubes 200 mm. (7.8 inches) in diameter. The mast is firmly fastened to the floor of the car and passes through a sleeve bearing in the roof of the car. By means of a hand brake operating a double set of gears the mast can be revolved by the motorman. It can be firmly held in its lower bearing by means of a wedge. There is a flange at the upper end of the lower part of the mast to which the tube carrying the collector rings is fastened. The flange is made of cast steel, and is surrounded by a hard rubber sleeve. Three contact springs press

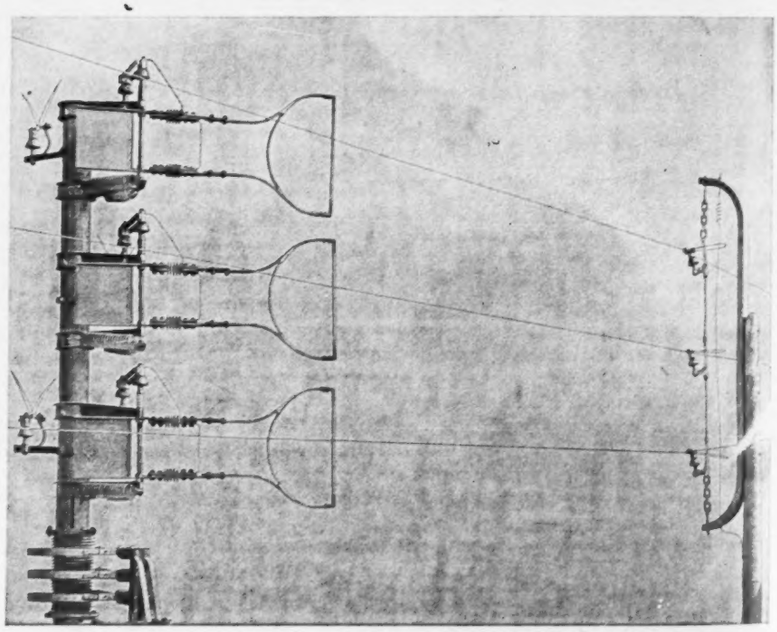


FIG. 26.—CURRENT COLLECTORS.

against the rings, which are fastened by means of hard rubber posts to a special block of iron, as shown in Fig. 26.

Into the insulating tube and partly also into the lower part of the current collector the upper tube is fitted, which can be easily taken off by the loosening of a few screws. This tube carries three revolving sleeves 1 m. (3.28 ft.) apart from center to center, which carry the actual collectors. On account of the enormous wind pressure occasioned by the high speed which might cause the collectors to leave the trolley wire, the collectors must not only be pressed against the

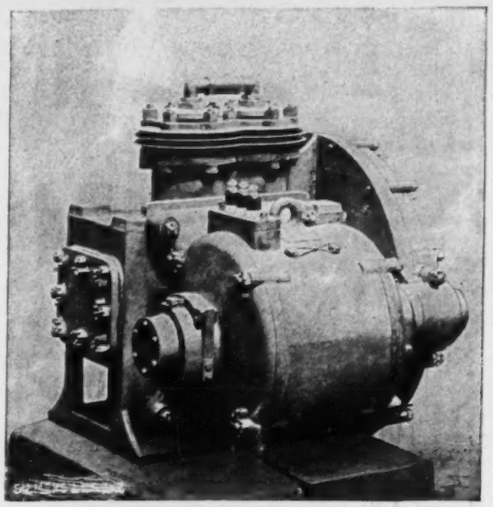


FIG. 27.—AIR PUMP, WITH MOTOR.

wire by springs, but the wind pressure against the collector must be equalized on the other side of the sleeve by a flat surface, as shown in Fig. 26. The collectors are made of steel tubing, as usual, and are detachable. To the upper points of the axis bell insulators are attached, the bronze caps of which are electrically connected with the collectors. From this bronze cap the current is collected by a contact spring, and from here goes to the lightning arresters and the collector rings. The lightning arresters are of the ordinary fork type. There are two current collectors on each car, so as to prevent the 200-ampere current from damaging the collectors and to eliminate the sparking at switches or section insulators on the line.

THE COMPRESSED AIR INSTALLATION.

The compressed air used for the operation of the brakes and the electric switches is supplied by two air pumps, driven by electric motors, which are located beneath the car directly below the platform. At a speed of 190 r. p. m. they compress 400 liters (88 gallons) of air at atmospheric pressure to eight atmospheres absolute. The pump is of the duplex type with two vertical cylinders in which the pistons are moved up and down by a crank-shaft. On the latter a large gear wheel is mounted, into which the small pinion of the motor meshes. The entire device is encased so that no dust or water can enter. The motor is supplied with current from a small trans-

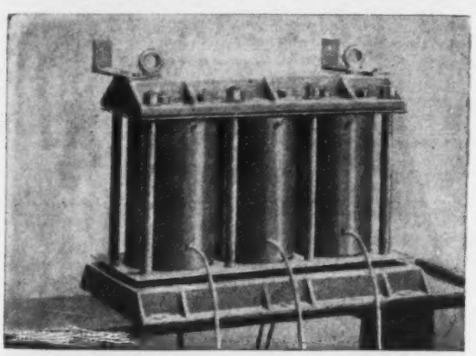


FIG. 28.—SMALL TRANSFORMER.

former (Fig. 28), which is constructed similar to the large transformer, and which is located on the roof of the car together with the high-tension switches. The high-tension winding is protected by three high-tension fuses.

The low-tension winding produces a pressure of 110 volts, and is connected by wires passing through iron pipes to the pump starting switch on the platform. The compressed air is stored in two tanks for the brakes and two tanks for the switches. The air pump is fastened to the iron frame of the car by means of U and angle irons.

APPARATUS FOR THE COMPRESSED AIR DISTRIBUTION.

The tanks above referred to are situated on the two platforms, one on each platform. The tank for the operation of the switches is

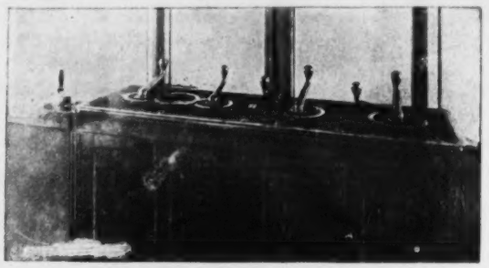


FIG. 29.—OPERATING TABLE.

fastened to the ceiling while the tank for the operation of the brakes is located at the left hand corner in the back of the platform. The pressure in this tank is 8 atm., in the other tank 4½ atm. Both tanks are connected by an equalizing pipe. The system is operated from a table located along the front of the platform. The table is connected with the various pipes in the car by heavy rubber tubes, which, of course, can be easily detached. The various cocks permit of three positions, as follows:

I. Connecting the switch cylinders with the atmosphere.

II. Cutting the switch cylinders off from the atmosphere and connecting them with the air tanks.

III. Switch cylinders connected with the atmosphere, but connection with the air tanks is cut off.

Onto the frame of the table are fastened one two-way cock for going backward and forward, and one, which is seldom used, for connecting the transformers in star and delta. Also a one-way cock for the motor switch and one for the controller. This is operated by the hand wheel on the motorman's table, which, as has been previously

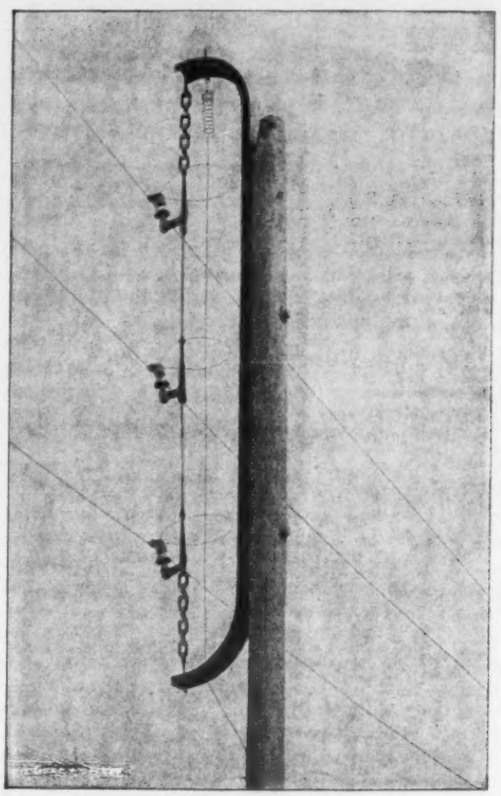


FIG. 30.—TROLLEY POLE, WIRE SUPPORTS, GROUND WIRE AND LOOPS.

explained, is connected by means of gearing with the main shaft of the controllers. The hand wheel moves around a scale with 29 divisions, and a pointer shows the exact position of the controller cylinders at any instant.

All cocks on the platforms are arranged directly beneath each other and are connected by rubber tubes and iron pipes with the starting cylinder which is located beneath the car floor.

Mounted above the table so that they can be read at a glance are two air-pressure gauges and three electrical instruments, a voltmeter, an ammeter and a voltmeter, indicating for kilometer-hours the pressure generated by a small dynamo coupled to the running axle. The voltmeter measure the secondary e. m. f. of the small transformer, but is so marked that it indicates in the transformation ratio of the transformer. In this way the actual line voltage can be read off. The ammeter measures the current of one phase of one of the four motors.

In the right corner of the platform, toward the rear, is the hand brake for braking the truck nearest to the platform. At the right side of the operating table is the air cock for operating the air brake. At the left side is an emergency cock, which is of the one-way type, but can be turned into two positions. When the car is running it connects the air tank with all the steering cocks; when placed in the emergency position, it shuts the air tank off from the switches and the atmosphere but opens the working cylinders of the switches into the atmosphere which causes the latter to open.

There is furthermore located on the platform a cock for the operation of the air pump. This is mechanically connected with the motor switch, and has three positions—"rest," "running," "pumps." In the "running" position the motor starts without a load, and after it is running the cock is set in position "pumps," when it is operated by the entire air pressure in the tank.

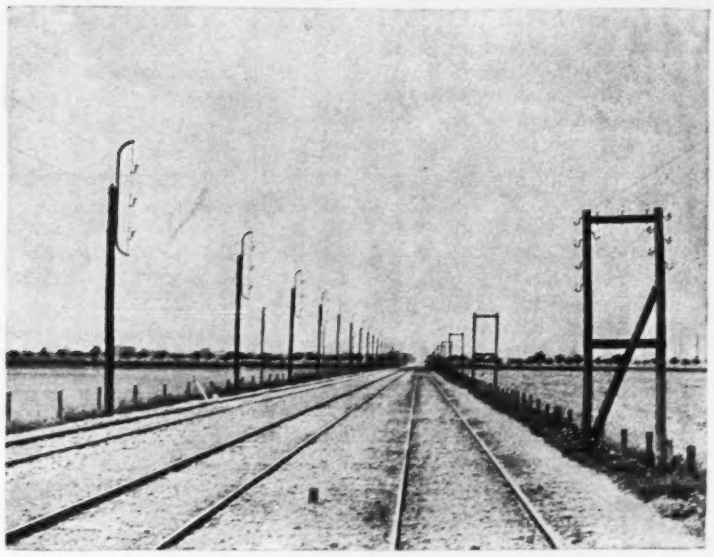


FIG. 31.—GENERAL VIEW OF POLE LINE.

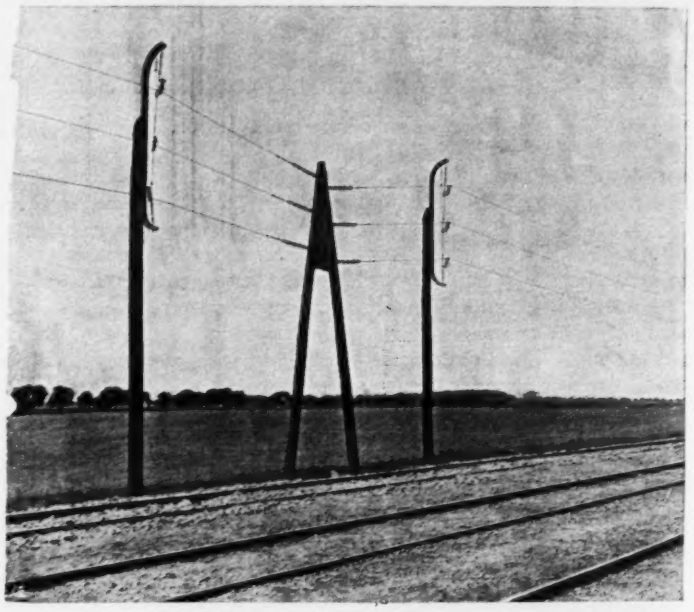


FIG. 32.—TYPES OF POLES BETWEEN VARIOUS SECTIONS AND AT TERMINALS.

DETAILS OF LINE CONSTRUCTION.

Referring to Fig. 1, Part I., it will be seen that the line extends from Marienfelde to Zossen, a total distance of 23 km. (14.26 miles).

Parallel to the track and 2¼ m. (7.38 ft.) from the center, toward the right side in the direction of Zossen, wooden poles have been placed 35 m. apart. To these the U-shaped arms, shown in Figs. 30 and 31 are fastened by three bolts. The trolley line is not rigidly connected to these arms as the connection is made by means of links as shown in the figure. This enables a uniform contact between the three collectors and wires to be obtained at all times.

The trolley wires are doubly insulated from the earth, so that each insulation alone will stand the maximum pressure of 12,000 volts. The high-pressure insulators are made of hard rubber. A wrought iron conical bolt 200 mm. (7.8 inches) in length is surrounded by a hard-rubber sleeve 5 to 6 mm. (about 0.2 inch) in thickness. There is a thread, 50 mm. (1.95 inches) in length at the upper end, and onto this the insulator is screwed. This is also made of rubber. The second insulation is the chain at top and bottom, also made of hard rubber.

Each of the trolley wires has an area of 100 sq. mm. (.15 sq. in.), and they are made of hard-drawn copper, and a conductivity of at least 97 per cent of chemically pure copper. The horizontal distance of the wires from the center of the track is 1450 mm. (4.75 ft.). The three wires are placed vertically above each other 1 m. (3.28 ft.) apart; the lowest wires being hung 5.5 m. (18 ft.) above the top surface of the rails.

The total line of 23 km. (14.26 miles) is divided into several sections in such a way that at distances of 1 km. (.62 mile) the wires are anchored in the direction of their length. To serve as an anchorage between two sections, and at the terminal points of the line two wooden poles are connected together and are supported, as shown in Fig. 32. This method enables the system to withstand a horizontal pull of 3000 kg. (6600 lbs.) at a height of 6 m. (19.68 ft.) above the rails.

These anchorage points take the place of section switches. In order to connect the several sections electrically, connecting wires are attached at these points, which can be easily removed in case it is desired to cut the current off from any one section.

At the anchorage points the collectors pass without touching the wires for a distance of 10 m. (32.8 ft.). As the two collectors on the car are 17.64 m. (57.85 ft.) apart the car is never without a supply of current.

To the right and left at a distance of 5 m. (16.4 ft.) from the anchorage points a pole is placed. It is located 380 mm. (14.82 inches) behind the row of trolley poles. This will insure a smooth gradual passing over of the collector from one wire to the other. Each section is supplied with a lightning protective device, in the form of a lightning rod fastened to the wooden poles.

A precaution has also been adopted against danger from a broken wire in the form of a device which grounds the current-carrying wire. At each point of support of the trolley wires is a loop of an 8 mm. (.312 inch) copper wire, as shown in Fig. 30, which is connected with the trolley wire by means of a clamp at the wrought iron cap, the clamp being fastened to the cap by a brass bolt. In case the trolley wire breaks the pull will turn the clamp, which in turn will pull the copper loop against a grounded 8 mm. (.312 inch) copper wire. The latter is coiled into a spring at its upper end, and passes down the pole to the rail, to which it is connected.

The rails are connected together by rail bonds of copper cable. By a special wire the rails are connected to the zero point of the system and every kilometer (2.2 miles) they are connected to the earth by special ground plates.

The feeders between Marienfelde and the power station at Oberschonweide of the Allgemeine Elektricitats-Gesellschaft, three high-pressure wires and a neutral wire, are partly bare wires mounted on porcelain insulators fastened to wooden poles, partly cables, in case bare wires could not be used. These have a cross-section of 70 sq. mm. (.108 sq. in.), the bare wires of only 50 sq. mm. (.0775 sq. in.). Under the bare wires, where it was found necessary, nets were spread. At Marienfelde the line branches off to the car shed situated nearby.

The Theory of the Electrolytic Rectifier.

BY DR. K. NORDEN.

THE purpose of this article is to advance a complete theory of the modern electrolytic rectifier, which has been wanting up to date. The subject will be developed according to the researches made experimentally in this line.

Although the practical progress made in the production and application of the electrolytic rectifier has been laid down in various patents issued during the last few years, still the theory has never been fully explained and the results of theoretical researches, which have been made in this line, are scattered in a great number of scientific periodicals. The author for this reason believes that a paper treating briefly on the theoretical side of the question may be of interest and perhaps may give a basis for further investigations concerning this interesting subject, which, until now, has remained in an uncompleted state.

The phenomenon in question may first be briefly explained. An electrolytic cell with one electrode of aluminum and the other of lead, carbon or any other suitable conductor, permits an electric current to pass in one direction only, viz., from the lead to the aluminum. In the reverse direction the current is reduced practically to nothing, especially if the aluminum electrode has been subjected to a previous treatment, called formation, except when a certain voltage is exceeded. Hence, it is evident that if an alternating current is sent through this cell, only the waves making the aluminum a cathode will pass, so that the current is "filtered" and transformed into an interrupted current of uniform direction. By proper arrangement, it is possible to utilize both waves in the same direction after having separated them, thus obtaining a continuous direct current in the working part of the circuit.

After the aluminum electrode has been exposed to the action of an alternating or a direct current, which latter has to enter the cell at the aluminum pole, the aluminum is changed in its appearance and is now covered by a thin film, the thickness of which varies somewhat with the electrolyte used in the cell and the time of this action or "formation."

At first the film is so thin that it cannot be observed directly, but its presence is indicated by the colors of interference appearing on the surface of the electrode. After a certain lifetime this film is easily recognized as a gray, dull coating, traversed by dark lines according to the structure of the metal. This film is doubtless the seat of the asymmetric effect on the aluminum electrode and a thorough investigation of its formation and properties must lead directly to a theory of the rectifier.

The film, when cutting down the current sent through the cell, may offer to it either a counter e. m. f. or a high resistance. In the first instance, we have the conditions of an electrolytic polarization, and this may be considered as analogous to the well-known case of the lead accumulator, in which the positive plate is covered with a layer of lead peroxide, and does not permit a current to pass, if its voltage is below two volts. However, this explanation of the film was soon abandoned. For the e. m. f. of two volts of the accumulator cell, due to the presence of peroxide of lead on the positive lead plate, is retained after the charge as long as there remains any residue of the coating of peroxide, while the counter e. m. f. of the formed aluminum, which can be brought up to a hundred and more volts, drops down immediately after the charging current has been cut off, though the chemical condition of the film has not been at all changed. A very small amount of e. m. f., not exceeding about three volts at the highest, is still left, representing the true value of the electrolytic polarization, but this is too low to justify this explanation of the process.

On the other hand, the electric resistance of the film has been measured and found to be very high. Professor Wilson[1] observed values up to 10,000 ohms, which practically can be considered as an insulating resistance. This would suggest the explanation given by the early investigators, who wrote about this subject (Ducretet, Beetz and others). They state that a high resistance introduced by the anodic film may rapidly stop the current, and thus produce a unipolar effect. Although in accordance with the present facts, this theory is too narrow to explain the physical behavior of the cell in all cases.

More light was thrown upon this subject from a new point of view, introduced by F. Kohlrausch's discovery of the polarization capacity of metallic electrodes,[2] and applied to the aluminum cell by Streints (1888), Scott (1899) and others. According to this theory, a layer covering an electrode represents the dielectric of a condenser. The coating of the latter is formed on the one hand by the metallic plate, on the other by an opposite layer of electrically charged ions in the electrolyte. In the present case, after having formed the dielectric film on the aluminum anode, the e. m. f. of the circuit then charges the said condenser to the value of its own voltage. After the cell has been disconnected, the tension of this condenser drops down immediately through self-discharge.

By means of this theory, we are enabled to explain the behavior of the aluminum cell even in cases where the old theory of resistance mentioned above fails. When placed in the circuit of an alternating-current dynamo, the aluminum cell acts like a condenser, carrying a current leading the e. m. f. in phase, and many researches were made along this line some years ago by Professor Fessenden of this side of the Atlantic and others abroad. After all, in many practical cases the aluminum cell can replace the ordinary condenser and thus at once has a certain use in some scientific laboratories. Most of the patents granted in regard to the application of the rectifying cell refer also to its use as a capacity.[3]

The well-known phenomenon of the luminosity of aluminum cells has to be explained in accordance with the above. This phenomenon was discovered abroad by Dr. E. F. Polzeniusz and exhibited at the meeting of the German Chemical Society at Frankfort-on-the-Main some years ago; and also independently in this country by Mr. W. S. Andrews, who recently exhibited such luminous cells in the Conversazione of the American Institute of Electrical Engineers. If the voltage impressed on the cell is increased to a certain point, then the aluminum plates seem to glow with a faint phosphorescence, growing brighter as the voltage is increased. If we consider the film on the plates as a dielectric, then the phenomenon results from a silent discharge, like that of a current passing through a Geissler or Crookes tube. If the voltage is still further raised, the discharge turns disruptive, stars or scintillations appearing on the luminous surface. This occurs when the stage is reached where the insulating power of the layer is unable to stand the pressure of the voltage any longer, and the dielectric breaks down in its weak points. However, the phenomenon remains continuous, for, when any point of the film is destroyed by sparks, it is immediately renewed by the electrochemical action of the current.

Summing up, the theory of the aluminum cell as a condenser based upon the high resistance of the film seems to be out of question, and the physical side of the problem is thus cleared up. However, the working rectifier is not a mere physical, but also an electro-chemical problem, and we have also to discuss the chemical properties and the chemical behavior of the insulating film before a complete theory may be advanced.

Owing to the extreme thinness of the layer of film formed on the aluminum anode, it seems to be almost inaccessible to ordinary chemical methods of analysis for want of sufficient material. Therefore, the opinions about the chemical constitution and the formula of the substance have been rather divergent. The first discoverer of the phenomenon, Buff,[4] considered the film as silicon, which is always contained in commercial aluminum to a certain percentage, and might be accumulated on the surface of the aluminum electrode if some of this metal is dissolved by the current. Later on Professor Beetz disproved this conception by experiments, and with many others assumed that a suboxide of aluminum is formed by electrolytic action; the existence of this suboxide has, however, never been proved in a satisfactory manner.

As the only means of deciding this question, exact chemical analysis was resorted to by the author of this article two years ago, and the results were published in the *Zeitschrift fuer Elektrochemie* in 1899. The author paid attention to the fact that the film formed on the anodic aluminum, does not disappear when the current is reversed, though it becomes inactive. When, after a while, it is submitted again to the anodic action, then the film separates from the electrode and a new film is formed in place of the former one. By repeating this process, a sufficient quantity of films was obtained for analysis according to the most exact chemical methods. The results of numerous analysis made revealed the fact that the film consists

[1] London *Electrical Review*, 1898, Vol. XLXIII.

[2] "Ueber die Polarisations kupazitat von Metallelektroden," *Wied. Annal.*, 1873 and 1874.

[3] U. S. Pat. No. 672,913, Electrolytic current rectifier and condenser, to C. Pollak, and other patents.

[4] *Liebig's Annal*, 1857.

of normal aluminum hydroxide, of the formula $Al_2(OH)_6$. Variations in the conditions of the experiment did not influence this result. As an electrolyte in these experiments dilute sulphuric acid was employed. The acid acts chemically on the aluminum hydroxide, forming the basic or neutral salt of aluminum sulphate. Consequently, there was found on the one hand a certain amount of sulphuric acid fixed by the film, and on the other a good deal of aluminum sulphate dissolved in the liquid. This action of the acid was ascertained to be a mere chemical one, accompanying the regular electrolytic formation of the hydroxide.

During these experiments, the effect of the electric current was continuously controlled by comparing the amount of gas set free at the aluminum with the weight of copper deposited in a copper voltameter placed in the same circuit. No reducing action at all was found to take place on the aluminum, when employed as the cathode, and the full theoretical cathode effect of the current was used up in developing hydrogen. This result was to be expected from the above stated chemical constitution of the film. For even nascent electrolytic hydrogen is not strong enough to reduce aluminum oxide or hydroxide, which, when formed out of its components, develops a heat of combustion greater than any other known substance.

The absence of any electro-chemical action on the aluminum cathode is a very important fact in the explanation of the working rectifying cell, and this must be remembered in considering any available theory. In the case of a real alternating current the alternations are apparently too fast to allow any separation of the film by subsequent cathodic and anodic action, nevertheless, the results of the writer's observations are applicable to the conditions of the working rectifier.

According to the facts above stated, one wave of the alternating current produces the insulating film, by converting the surface of the aluminum into hydroxide, while the opposite wave does not have any effect on the same. But the important question arises, How is it to be understood that in a circuit with aluminum as the cathode, the current can pass almost freely through the cell, if the high-resistance anodic film still remains unchanged?

Before answering this question, I wish to call attention to an observation which is familiar to every one who has studied the aluminum rectifier. If after the generation of the film, the forming current is disconnected and the cell left to itself, then the aluminum electrode loses its insulating power in a sort time. Introduced again in the forming circuit, it carries at once a considerable current depending on the length of the time it rested, as if the aluminum electrode were used as cathode and the insulating coating became inactive. On the surface of the aluminum anode the developing gas marks the points where the current enters the electrode, until complete formation is restored.

This observation, I believe, can easily be explained in accordance with the above described researches by pointing out that the film of aluminum hydroxide has a certain chemical solubility for all the usual electrolytes, due to its double reaction of a base as well as an acid. Hence, if the cell is left to itself, the liquid by mere chemical action, soon corrodes some weaker points of the coating, thus destroying the insulating power of the electrode. The current, when connected again, passes freely through these low-resistance points, at the same time touching up the coating by its electro-chemical effect. The chemical dissolution, however, must be imagined as a very slight one, as the layer or film itself is extremely thin.

Granting once that a certain dissolution takes place in the resting cell, then the same must be the case with the working cell. The aluminum anode, as a matter of fact, never stops the current entirely, as may be easily recognized by some bubbles of gas evolved from its surface. But, of course, this dissolution and, therefore, the reduction of resistance, never can exceed a certain stage, because the forming effect of the current continuously restores the weakened points of the coating in the same manner as the breaking down in points of the film in the luminous cell, above described, is kept continuous. If the current is reversed, so that the aluminum becomes the cathode, this restoring action is lacking. Dissolution and reduction of resistance is going on as in the resting cell, and in the same way it is easily understood how the current passes freely through the cell.

As a consequence of the explanation herewith given, the efficiency of the different electrolytes used in the rectifying cells ought to be very distinct, according to their respective dissolving power, and, in fact, practice shows conspicuous differences between the same. However, whether these differences are at the same time in exact proportion to the dissolving power of the electrolyte, as the theory would require, is a question which may not be decided at present. There are only a few chemicals which offer as great a variety of modifications physically as aluminum hydroxide. These modifications differ principally as to their solubility, and we are not yet able to say which of these different modifications of the aluminum hydroxide forms the film on the anode.

However, the theory advanced is not in conflict with any fact of chemistry, and explains the electro-chemical process in quite a satisfactory manner. It is based on chemical analysis and is in harmony with the practical and scientific knowledge of the present electrolytic rectifier.

The Telephone as An Information Bureau.

MISS BLANCHE ASHLEY.

One of the unique departures inaugurated by Mark Davis, until recently general manager of the Cuyahoga Telephone Company, Cleveland, in connection with the service of the company, is a public information bureau. Although the scheme has only been in operation for about six months, it has already become one of the most valuable features of the Cuyahoga system; one which has unquestionably done much toward popularizing the service with the general public. The bureau has a special number, and it averages more than double the number of calls of any line on the boards. It is utilized by all classes of people, and the variety of questions asked are almost as numerous as the stars in the heavens. Naturally, the person in charge has not only to be a walking encyclopedia, but must be well up on current affairs of all kinds. Such a person is hard to find, and it was months after Mr. Davis first developed the scheme in his mind that he finally found the right one. Miss Blanche Ashley, who has been in charge of the bureau since it was firmly established, is a young woman of more than ordinary attainments. She is well educated, well read, cultured and refined, and has had experience in a position where much learning, patience and perseverance were required—that of endeavoring to educate imbeciles at a State institution.

The information bureau now at the Cuyahoga exchange is fitted up expressly for the purpose. It is apart from the main exchange, and it is provided with a very complete reference library. There are encyclopedias, dictionaries, hand books, time tables, geographies, histories, works of law and medicine, religious reference books, directories of Cleveland, and many other cities; in fact, a list of books which might in any way contain the answer to any question likely or unlikely to be propounded. Questions are written out as they are asked with the telephone number, and address of the inquirer. Sometimes they can be answered at once, but frequently the reference books must be referred to. Often the operator is obliged to call up some one who is likely to be familiar with the matter in question, and frequently it is necessary to enter into the correspondence with parties in other cities before the information can be obtained. Sometimes questions are asked which are clearly outside the province of the bureau, and in such cases the inquirer is referred to some one who is likely to be able to furnish the desired information. Of course, the majority of questions are concerning matters of common occurrence. People want to locate parties in or out of town, to learn addresses of business houses or manufacturers of certain articles, time of arrival or departure of trains, best routes to given points, what the weather is likely to be, postal rates, etc. The location of fires is a frequent question, and the most common during the summer time is concerning the baseball score; in fact, this is sometimes asked a hundred times a day, and the operator never keeps any record of this question. Sometimes the questions are silly, and these are discouraged, sharply and sarcastically.

The bureau is for public information, but at first starting the funny man was much in evidence, asking such questions as "Can a man

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marry his widow's sister," but a few sharp turn-downs were effective. The questions are now more reasonable, although many of them are extremely difficult. Among the questions asked in a single day recently were the following:

"Will money lost in a registered letter be refunded by Uncle Sam?"

"What is the average number of tons of coal consumed on a voyage by an ocean steamer?"

"In what county is Glastonbury, England?"

"What are the necessary preliminaries to become a notary?"

"Is there any law to prevent a President from holding a third term?"

"What is the greatest and average depth of Lake Erie?"

"How much does a cubic foot of gold weigh?"

"What is the cost of a copyright?"

"How old is Olga Nethersole?"

"Will the people of Cuba vote for the President of the United States?"

"What was the cost and displacement of the steamers 'Great Eastern' and 'Celtic'?"

"To what countries do Greenland and Iceland belong?"

"What is the total valuation of the world?"

"May a man shoot rabbits on his own farm?"

"How far is it to heaven?" (This is from a funny man.)

"Are stamps required on a letter to the White House?"

"Is there any clause in the Constitution permitting a woman to become President?"

Another scheme of inducing subscribers which has been worked by Mr. Davis with great success is that of calling attention to non-subscribers to the fact that they are losing business by not having the Cuyahoga connection. The "new number operator" at the exchange keeps a careful record of parties who are asked for but who do not subscribe to the service. Once a week a postal card is sent to the various parties stating the number of times they have been asked for, the opinion being presented that they are handicapped by the lack of service. A few days later a solicitor makes a personal call. The argument is one which counts for much, and it generally has the desired effect.

New Telephone Patents.

Among the telephone patents of last week are two granted to Frank B. Cook, of Chicago, one on a system including a new form of generator switch and a method of ringing without the use of ringing keys, and the other on a form of distributing board. In the Cook system the generator at the subscriber's station is normally out of circuit. When the crank is turned a friction wheel is put in action which pushes up a contact roller that acts on a set of contact springs, connecting to generator to the line and opening the contact that normally closes the line round the generator circuit. The arrangement is ingenious, but involves the use of no fewer than four spring contacts and practically does not appear to accomplish more than any of the standard devices for cutting the generator armature in and out of circuit.

The ringing device is especially adaptable to four-party lines equipped with polarized bells and operated from non-multiple boards. On inserting the plug in the appropriate jack and pushing the plug home, the tip of the plug, pressing against a projection of insulating material on the line spring, pushes the line spring upward against a contact spring connected to a generator. When pressure on the plug is released the plug is automatically pushed back by the line strip and then establishes the contacts required for talking. Two generators are supplied, one with the positive pole permanently connected to certain jacks, and the other with the negative pole connected. Mr. Cook also shows an arrangement, involving a rather more complicated form of jack, which enables one generator to be used for both positive and negative signals.

The other patent granted to Mr. Cook covers the detailed arrangements of a wooden distributing board with binding post terminals mounted on ebonite strips. The general adoption of metal distributing frames with clips for soldering all connections will naturally limit the field of application of this device.

To William S. Paca, of Erie, Pa., is granted a patent on a highly

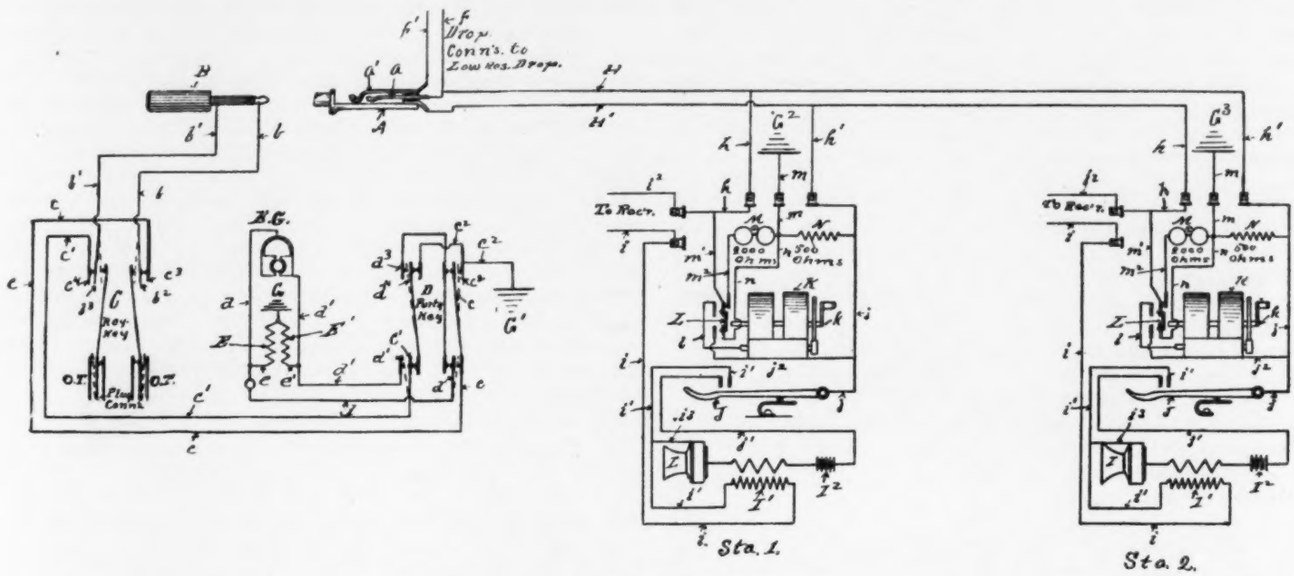


DIAGRAM OF SELECTIVE PACA TELEPHONE BELL SYSTEM.

ingenious selective bell system, involving somewhat complicated apparatus at subscribers' stations and central office, but avoiding the use of polarized bells—that is, of plus and minus bells. Referring to the accompanying diagram, it will be seen that the bell at Station No. 1 is permanently connected to line H of the metallic circuit, and the bell at Station No. 2 to line H^1, the bells being worked on a grounded circuit formed of one leg of the metallic circuit for each bell. At each station, interposed between the ground to which the bell is connected, and the opposite leg of the circuit is a resistance coil of preferably 500 ohms. These coils prevent the ground at either station from interfering with the operation of the other. In each case the coil N operates not only to resist the passage of currents from the line j to ground when the bell at the other station is operated, but also operates to prevent part of the current passing through the bell being rung from passing to the line j and then through its line connections to the bell magnets M at the other station.

The exchange generator is connected to ground through a split resistance coil; the party key D operates to put one generator lead to ground and to connect the other, through the ringing key C, to the tip of the plug for ringing Station No. 1 (by line spring a and line H), or to the sleeve of the plug for ringing Station No. 2 (by line spring a^1 and line H^1). In each case a ground G^1 is put on the line by the party key to prevent a false signal being transmitted to the other station in case the called subscriber takes down the receiver while the call is being made, which would throw a bridge across the line

and divert the generator current from H to H^1, or vice versa, as the case might be.

When either station calls the exchange, the circuit from the generator is through one lien and the exchange drop and back through the other line to ground at the station. The resistance coil N at the second station prevents the ground there from interfering. When the exchange desires to signal an ordinary metallic circuit station the party key D is moved so as to cut out the ground G^1, closing $c\,d$ and $c^1\,d^1$. Then coils $E\,E^1$ are interposed between the generator leads and the ground G, and the generator is in circuit in the usual way. While this arrangement effects an operative two-party selective bell system without recourse to bells of special polarity, the object is effected, as will be noted, at the expense of fairly complicated circuits and apparatus.

CURRENT NEWS AND NOTES.

YERKES IN LONDON.—A cable dispatch from London of Oct. 19 says: It is understood that the Brompton & Piccadilly and the Great Northern & Strand Tube railways will combine their interests. The construction of both roads has been authorized by Parliament, and Charles T. Yerkes has arranged the combination scheme.

FOUND BY WIRELESS TELEGRAPH.—During a recent fog, when the "Lucania" was due but did not show up at her New York dock, Mr. Vernon H. Brown, the Cunard agent, had the Marconi operator on the "Umbria," then lying there, try if he could "raise her." Sure enough, a wireless reply came at once through the fog, stating that the "Lucania" was anchored outside the bar, waiting to come up when the fog lifted. The test was a very pretty one, as there was a dense fog and the boats were miles apart.

PRESIDENT M'KINLEY'S CASE.—The doctors' report on President McKinley's treatment has just been issued in the *New York Medical Journal.* In regard to the reasons for not using the Röntgen rays, Dr. Mann says that at no time were there "any signs that the bullet was doing harm. To have used the X Ray simply to have satisfied our curiosity would not have been warrantable, as it would have greatly disturbed and annoyed the patient, and would have subjected him also to a certain risk. Had there been signs of abscess formation, then the X-Ray could and would have been used." It may be questioned whether Mr. McKinley would have been alarmed, and as to the "risk," we should greatly like to know what it was. The fact remains that the bullet was not located when it could have been easily.

PENNSYLVANIA RAILROAD TELEGRAPHS.—In regard to recent rumors anent Western Union and Pennsylvania Railroad, an official of the road is quoted as follows: "I do not say positively that we will discard the Western Union service, but I will say that we are installing the Delany system for commercial purposes, and that in two weeks it will be working between here and Altoona, with all probability of its extension to Jersey City, Chicago, Pittsburg, Baltimore, Washington, and, in fact, all the larger points along the Pennsylvania lines. Then, with our wire facilities, we will be more than able to serve the public. Mr. Delany has transmitted a readable code and made a record of 8000 words a minute. At the Buffalo Exposition he is every day sending 1000 words a minute. At this rate one wire would do the present Western Union work between here and Pittsburg, and we have from 8 to 10 of our own wires all the way."

SUBMARINE BOAT LAUNCHED.—At Elizabethport, N. J., on Oct. 19 the submarine boat "Shark" was successfully launched at the Crescent Shipyards before a distinguished company. The vessel was christened by Miss Wainwright, daughter of Commodore Richard Wainwright. She is one of five torpedo boats built by Lewis Nixon for the United States Government. The ones already launched are the "Adder," "Porpoise" and "Moccassin." She is 63 ft. 4 inches in length and 11 ft. 9 inches beam. The displacement submerged is 120 tons. She has a 160-hp gasoline engine for surface running and a 70-hp electric motor for driving her under water with storage batteries. She is expected to make a speed of 8 knots an hour on the surface and 7 knots when submerged. She is armed with five Whitehead torpedoes. The only exposed part of the boat when not submerged is the conning tower, which is made of harveyized steel 24 inches in diameter and 4 inches thick.

POLYPHASE CURRENTS IN ELECTRIC TRACTION.—In the discussion at the Street Railway Convention of the paper on "Alternating and Direct-Current Transmission on City Lines," which appeared in abstract in our convention report, the author, Mr. M. S. Hopkins, said that in Columbus, Ohio, it was found that the loss of energy in direct-current feeders as determined by wattmeter readings, ranged normally from 23 to 31.2 per cent, and reached 50 per cent during hours of heavy load. A rotary sub-station enabled copper to be taken down, having a market value of $27,000. The high-potential transmission line substituted only required copper to the value of $10,000, which left $17,000 to be credited to the sub-station. The loss in energy is now kept well within 15 per cent between the main sub-station and the sub-station bus-bars, even during periods of heavy travel, which results in a yearly saving of $3,804 in the cost of power, or equivalent to 12 per cent on the cost of the sub-station investment. In the discussion, Mr. Crosby said that if the city is a very compact one only in exceptional cases will the use of polyphase currents be justified. In some of the smaller cities, however, the use of alternating currents for railway service is desirable where power is also supplied to suburban and interurban roads.

A TELEPHONE REPEATER.—A curious solution of the telephone relay problem is offered in a patent granted Oct. 15 to one Bela Gati, of Temesvar, Austria-Hungary. The inventor connects one winding of each of two repeating coils by a circuit containing a generator and an arc lamp, which may be either in series or in parallel with the windings of the coils. The theory is that the weak telephone currents traversing the transmitting circuit, act by induction upon the lamp circuit and cause corresponding increase and decrease of current therein, which in turn will cause the carbons of the lamp to vary in their separation, thereby decreasing the resistance of the lamp circuit and increasing the supply of current from the lamp supply circuit. This amplified current will correspondingly reinforce an induction coil in circuit and send out to the receiving telephone much stronger impulses than were created by the voice in the speaking circuit. This is certainly a strikingly bold attempt at the telephonic relay problem, but it would require a delicacy in carbon feeding mechanism difficult to attain, to say the least, while in practice the arc lamp circuit, through its normal fluctuation, would have something to say for itself with rather a disturbing effect on telephone currents.

STORAGE BATTERY PATENTS.—Among the patents of Oct. 15 are six on storage batteries, three of which were granted to Robert McA. Lloyd, and three to Charles S. Kaufmann. The earliest in date of application of the Lloyd patents is on a storage battery for boats, and relates to means for insulating a battery from the machinery and hull, to details of a battery compartment, including its ventilation and drainage, and provision for an alarm to give notice when the battery solution is leaking. The two other patents are on applications filed the same date, and also relate to details of a battery compartment in a boat, and more especially a submarine boat of the "Holland" or similar type. They describe details of insulation and drainage of the battery compartment, and means for drawing off the gases set free in the charging. The Kaufmann patents describe the construction of a storage battery plate and of a separating insulator. The insulator is made of vulcanized rubber or other suitable material, and has the form of a hairpin, which is so shaped at the neck that when it is slipped over the head of a plate the legs are caused to be thrown outward. When the plates of an element are assembled the legs will be forced in contact with the surface, and this will lock the neck of the insulator on the head of the plate. In one of the other Kaufmann patents a plate is described, which is constructed by making a series of grooves in a flat lead plate, whereby ridges are produced at right angles to the plane of the plate. The plate is then subjected to a pressing or rolling operation, which causes the ridges to be pressed down flat upon one another so that their edges overlap. When the plate is being formed the peroxide of lead gradually presses the leaves apart, and at the same time is firmly held in place by the pressure of the leaves. By this means cavities are filled with peroxide without the addition of other means. The third patent describes a plateholder with provision for holding a plurality of plates. The advantage of such a holder is stated to be that if one of the plates be destroyed or injured it may easily be removed and a new one inserted, the loss, therefore, not including the holder as in the case of the usual form of plate.

WIRELESS TELEGRAPHY FOR LLOYDS.—A recent London dispatch states that the Marconi Wireless Telegraph Company and Lloyd's shipping agency have entered into an agreement whereby the stations of the agency throughout the world are to be equipped with wireless apparatus.

A REUTER JUBILEE.—In London on Oct. 19 Baron de Reuter gave a dinner in celebration of the jubilee of the establishment of Reuter's Agency, which his father founded in 1851. Sir John Hay, chairman of Reuter's Telegram Company, Limited; Baron George De Reuter, the Hon. Mark Napier, representatives of the Associated Press and the Havas and Wolff bureaus, the great agencies with which Reuter's company is allied, and many others were present. Telegrams of congratulation from all parts of the world were received during the dinner.

ENGLISH PACIFIC CABLE.—It is stated from Victoria, British Columbia, by Mr. James Wilson, superintendent of the Canadian Pacific, telegraphs that Mr. Lockwood, who has charge of the work of preparing the landing of the Pacific cable, and two engineers, have started for Banfield Creek, on the west coast of Vancouver Island, 104 miles from Victoria, to make arrangements for the site for the landing place. Wharves will be built, and houses to accommodate the staff, which will consist of about 40 men. The cable repair ship will not have its headquarters on this coast as previously announced, but at Fiji.

AMERICAN TROLLEYS IN ST. PETERSBURG.—Enterprising American street railway promoters have invaded St. Petersburg, and have, according to a dispatch to the London *Standard*, submitted a proposal to take over the entire tramway system of that city under a twenty-five years' contract, the lines to be relaid and extended in all directions, and horse cars to be replaced by electric cars. The scheme includes the building of a substantial bridge across the River Neva to replace the existing wooden structure. The capital, to be raised in the United States, will be 100,000,000 roubles, half of which will be in ordinary shares and the remainder in guaranteed.

ELECTRIC RAILWAY SYSTEM.—A railway patent which, if it had been granted within several months after the application was filed, would now be on the point of expiration (the application is dated Aug. 14, 1884), was issued Oct. 15 to Benson Bidwell, of Philadelphia. The patent relates to an electric railway system in which slotted tubular conductors are used. As illustrated, there are two slotted conductors supported between the rails. On a pair of arms attached to a car are mounted two collectors or trolleys, which enter the tube through a slot in its lower portion. The slotted tubes are in sections independently supported so that one may be removed without removing an adjoining section. The claims also refer to the details of the insulation of the tubes and to the collecting arrangement.

INSTITUTE MEETING.—As noted last week the subject for the New York meeting of the A. I. E. E. on Oct. 25 will be "Regulation in Prime Movers and Successful Operation of Alternators," with an introduction by President Steinmetz. The following papers will be presented: "Angular Variation in Steam Engines," by Mr. P. O. Keilholtz, of Baltimore; "Parallel Operation of Engine-Driven Alternators," by Mr. W. L. R. Emmet, of Schenectady; "Parallel Running of Alternators," by Mr. Ernst J. Berg, of Schenectady; "Angular Velocity in Steam Engines, in Relation to Paralleling of Alternators," by Mr. Walter I. Shlicter, of Schenectady. It is expected that other papers also specially prepared for this meeting will be presented, as many engineers in electrical, steam, gas and hydraulic interests have been invited.

A NOVEL TROLLEY SCHEME.—It is stated from Scranton, Pa., that abandoned subterranean mine workings converted into a subway will be utilized by the Pennsylvania Railroad to get into Scranton. For years this company has endeavored to extend its line from Wilkesbarre to Carbondale via Scranton, but until this novel plan was hit upon they were unable to do so. The company has purchased the immense tract of land formerly occupied by the Lackawanna Iron & Steel Company, which is removing to Buffalo. From this point access will be made to the heart of the city through old mine workings. It is also stated that the Westinghouse people are to erect a building on this newly acquired plot to put in an electrical equipment. The line between Wilkesbarre and Carbondale will be operated by electricity entirely.

BREMER ARC LAMP.—A number of details relating to the Bremen arc lamp form the subject of a patent issued Oct. 15. With the Bremer compounded electrode it is desirable that the carbon pencils shall not be vertically in line as in the usual form of arc lamp, but at an angle or parallel to each other. The patent relates to details of a chamber above the arc for reflecting the light downward, and to an arrangement whereby a magnetic field may be produced for the control of the arc; also means for priming the arc, this being necessary, owing to the disposition of the carbons and the fact that they cannot be brought into contact with certainty by simply moving the carbon points toward each other, on account of the slag deposited on their ends, this slag being due to material compounded with the carbon for the purpose of modifying the character of the light.

A BLIND TELEPHONE GIRL.—The following from Mattoon, Ill., is not without a pathetic interest: Miss Abbie Downing, a blind girl of 23, began as an operator of the Metcalf, Edgar County, telephone exchange three weeks ago. Now she is the most expert operator the company ever had. Miss Downing handles a board for 60 telephones; also takes charge of the toll station, and by an accurate system of bookkeeping makes a record of all toll charges. She locates a call on the board by the sound of the "drop," or, if busy and the warning call click has not been heard, extending her nimble fingers over the exchange board. She graduated from the Indianapolis School for the Blind in 1893, and can perform all household duties—cook, sew by hand or machine and do fancy work. Miss Downing is a splendid musician, and has taught music. She is the only blind telephone operator in the country.

BRITISH SUBMARINE BOATS.—The cable brings the news of the beginning of a series of tests of the first of the new British submarine boats. The vessel was launched about a week ago, in great privacy, and so far has received neither name nor number. She is 63 ft. long with 11 ft. 9 inches beam, and is specially designed on lines to minimize resistance when cruising on the surface, where she will be propelled by a gasoline type of main engine capable of maintaining a maximum speed of about nine knots on a run of about 400 knots. When she is submerged an electric motor will give a speed of seven knots for a four-hours' run. This motor will be worked by means of storage batteries. She is lighted by portable incandescent electric lamps. Stored compressed air secures the air supply and ventillation, and the gasoline vapors from the engine will be carefully excluded. In steering and diving, her movements can be regulated either by mechanical or hand appliances. Her four sister boats are all in an advanced stage of preparation, and will soon be afloat.

AUTOMOBILE RACES.—Twelve races, to establish, if possible, straightway mile records have been arranged by the Lond Island Automobile Club for Saturday, Nov. 16, on the Coney Island Boulevard. The first race will be called promptly at 1 o'clock, but the events will be preceded by an automobile parade, to form at 11.30 o'clock in the vicinity of the City Hall, Brooklyn, and to proceed via Prospect Park to a point near King's Highway, where the races will be started. As the course will be a straight one-mile road it is expected that new r cords will be established for the mile by several classes of machines. The events will be: First, motor bicycles; second, motor tricycles; third, gasoline vehicles 6 horse-power or under; fourth, gasoline vehicles over 6 horse-power, and including 9 horse-power; fifth, over 9 horse-power, including 15 horse-power (gasoline); sixth, over 15 horse-power, and including 20 horse-power (gasoline); seventh, over 20 horse-power (gasoline); eighth, steam vehicles (stock); ninth, steam vehicles (special racing); tenth, electric vehicles (stock); eleventh, electric vehicles (special racing); twelfth, open championship race, to be run in trials and a final. The winner in each class will be eligible to compete in the final, provided the time made for the mile is 1.30 or better. All events are to be run under the racing rules of the Automobile Club of America. The Long Island Automobile Club will award cups to the winner in each class, and a special cup, known as the Long Island Automobile Club Cup, will be given to the winner of the open championship. All contests against time to be with flying starts. Contestants will be given probably one mile in which to work their vehicles to top speed, one mile for the record, and about one-half mile for slowing down.

PNEUMATIC TUBE MAIL SERVICE.—The Postmaster-General recommends the reinstallation of the pneumatic tube service in all cities in which it was formerly in operation. He claims that the service was a mechanical success, and that no suitable substitute has been found. We venture to think that electrical methods would afford an excellent substitute.

CHICAGO ELECTRICAL ASSOCIATION.—Since the announcement previously made in these columns of the programme of the Chicago Electrical Association some changes have been made so that it now stands as follows: Nov. 1, 1901, "The Storage Battery in Telephone Work," by J. G. Wray, electrical engineer Chicago Telephone Company; Dec. 6, "Demonstration of High-Frequency Effects," by Arthur Vaughn Abbott; Jan. 3, 1902, "Proposed New Rating of Incandescent Lamps," by John D. Nies, instructor in electrical engineering Lewis Institute. Dec. 6, the evening of the lecture by Mr Abbott, the meeting will be held in the Auditorium of Lewis Institute instead of at the regular rooms in the Monadnock Block, and ladies will be invited.

LECTURE ON INDUCTION MOTORS AT CHICAGO.—Professor William Hand Browne, Jr., of the University of Illinois, delivered a lecture before the Chicago Electrical Association the evening of Oct. 18 on the induction motor. The lecture was illustrated with stereopticon views and diagrams. In introducing the subject, Professor Browne said that the induction motor combined the features of static transformers and shunt motors. He then gave a brief elementary review of the fundamental magnetic principles of the induction motor. Some of the early forms of the induction motor having solid iron armatures were described. The methods of starting by the use of an auto-converter and by the use of resistance in the circuit of the armature or rotor were discussed, and it was explained why such large quantities of current are taken by the auto-converter method, at starting; and also why the method of introducing resistance in the armature circuit requires much less starting current. In the latter case, the torque is larger in proportion to the current flowing and the total current is also less. Diagrams of the connections of most of the single-phase induction motors that have been actually in use were given with special reference to the Wagner single-phase type. The greatest mechanical objection to induction motors Mr. Browne considered to be the fact that in order to make the power factor low the clearance between the rotor and stator must be very small, so that very little bearing wear is allowable. If the clearance is increased, the power factor is necessarily lowered very perceptibly. In general, the induction motor was said to be suited to all places where the direct-current shunt motor would be used. In places where direct-current series motors are used the induction motor is not by any means as suitable in its present development, because the induction motor is essentially a constant speed motor. In the discussion which followed, Professor Woodworth, of Lewis Institute, was very enthusiastic in the support of the induction motor in every location where shunt direct-current motors are now used, but condemned it for places where the characteristics of a direct-current series motor are required.

LETTERS TO THE EDITORS.

Wireless Telegraph Reports of the Yacht Races.

To the Editors of Electrical World and Engineer:

Sirs.—Observing your articles on wireless telegraphy in connection with the International yacht races, I would say that this company reported the races successfully and accurately by wireless telegraphy every day of the races, without interference from the other system (Marconi). We furnished bulletins of the races to such papers as *New York World, New York Journal, Washington Evening Star, Denver News, Los Angeles Times, Philadelphia Inquirer, Philadelphia Record, Philadelphia Evening Bulletin, Philadelphia Telegraph, Philadelphia North American, Philadelphia Item,* and others. Besides, the Associated Press also used our service, and gave us due credit for the same. On Friday, October 4, the last day of the contest, 103 bulletins were received by wireless telegraphy at our station at Galilee, of which 98 were published as a matter of news. Another matter in your article incorrectly stated was the "'American system being used in connection with the Publishers' Press Association." Such was not the case. There was a third system (we are informed it was a Chicago party), that endeavored to report the races, but from all information we have received, it was an utter failure. From the fact that the Associated Press who used the Marconi system were very anxious to use this company's dispatches and bulletins and later were connected to our Galilee station by wire, we are led to infer that the Marconi people also were not successful, and were interfered with by us. We have on file letters from the leading newspapers, complimenting us in the highest terms of praise, for our excellent, accurate, prompt and superior service. So, therefore, we can positively state we suffered no interference, as our instruments were properly "tuned."

AMERICAN WIRELESS TELEPHONE & TELEGRAPH COMPANY,
G. P. GEHRING, *President.*

PHILADELPHIA, PA.

[In order that no injustice might be done by the report in our Oct. 12 issue to the American Wireless Telephone & Telegraph Company, we have taken particular pains to investigate the claims and statements made in the above letter. The general manager of the Associated Press informs us that the American Wireless Telephone & Telegraph Company furnished no bulletins whatever to it. The *New York Journal* informs us that the bulletins of the American Wireless Telephone & Telegraph Company were useless, as they always came in late, after the Associated Press bulletins, and were so nearly like the latter that nothing new was obtainable from them. The *Journal* has further stated to us that the Associated Press service was most accurate and prompt throughout all the races. The New York *Evening World* discarded the American Wireless Telephone & Telegraph Company's service almost entirely after the first day. "This was due to the fact that whoever was sending reports did not know his business. The service itself seemed to work well—at least, there was a continuous receipt of messages." Our reference to the system used by the Publishers' Press is correct. The system was that of the "American Wireless Telegraph Company," as stated, and not that of the American Wireless Telephone & Telegraph Company. Our correspondent has apparently confused the two titles, owing to their similarity.—EDS.]

Lighting at Omaha and the Pan-American.

To the Editors of Electrical World and Engineer:

Sirs.—I note your editorial reference to the list of Pan-American awards in your issue of Oct. 19, and your comment upon the fact that so far no recognition has been made by the authorities of the Exposition of the illumination, of which you have been kind enough from time to time to speak in the highest terms of praise.

Permit me to offer, what is not intended as a correction of your remarks, but as an elucidation of one or two points that may help to confer merit where the merit is due. My own share in the work at Buffalo is, I presume, too well known to the profession to need any further reference on my part, but I would like to point out that the Pan-American effects which have elicited such world-wide encomiums were in reality rehearsed some few years ago at the Omaha Exposition, so that any claim based on originality alone at Buffalo would fall to the ground. When, as consulting electrical engineer of the Omaha Exposition, I suggested that all the exterior illumination effects there and at the approaching Pan-American could be obtained solely with the incandescent lamp, there were many sceptics, but the plan received the utmost encouragemnt from Mr. Edison, and backed by the support of so great an authority I had no hesitation in going ahead and trying there what could be done later on a large scale at Buffalo. I believe it may be claimed that at Omaha the outline plan of the illumination, rising slowly from a minimum to a crescendo, first reached its highest effect. The display at the Pan-American can only be characterized as pushing to its logical limits the preliminary work thus carried out experimentally but successfully at Omaha. It may be noted, in proof of this, that the highest award possible was conferred at Omaha for the lighting effects.

As a matter of fact, the results secured at the Pan-American owe no small measure of their charm to accident rather than design, particularly in regard to the slow bringing-up of the illumination from its first faint glow until it reaches full splendor. The methods projected at first to attain this result, on previous lines, were found pro-

hibitive as to cost, but the result was attained in another direction. It will be remembered that the current has to be thrown on by means of a water rheostat, a specific device here employed on a scale of magnitude previously quite unknown in the art. The problems in connection with the rheostat were admirably solved by Mr. W. Le Roy Emmet, of whom I was glad to note an appreciative biographical sketch in your issue of Oct. 5. Back of the brilliant spectacle shown nightly at Buffalo has been this special engineering work of Mr. Emmet, which alone in reality has rendered it feasible; and the very conditions exacted by the manipulation of current in such volume from Niagara have been the means for furnishing those gradations which may be said to give dramatic touches to the effect that has so gratified every observer.

Personally, I can never forget that it was through the enterprise and public spirit of the authorities of the Omaha Exposition that we were enabled to rehearse the "glories which have crowned the Pan-American."

New York, N. Y. Luther Stieringer.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors and Transformers

Phase Swinging.—Thornton.—The first part of an article giving "Notes on rotary converters and phase swinging." The name phase swinging has been given to the oscillations of the "current sheets" in synchronous motors or synchronous converters running under any load when this is suddenly changed. In its more general use it applies to the case when these oscillations have so disturbed other machines in the circuit that they exhibit the same effects, or when the generator is also affected. All risk of phase swinging being cumulative throughout the circuit, is prevented by the use of damping coils, consisting of high conductivity metal frames placed around the poles close to the faces, their action being as follows: There is a sudden change in the demagnetizing force due to the armature currents whenever the demand on the continuous side of the machine varies. This causes a change in the total flux through the pole, and during this change eddy currents are produced. This change of flux induces a voltage in the damping coil and, by reason of its very low resistance, a powerful current passes round the coil, reaching several thousand amperes for heavy loads. This current causes a strong wave of magnetic force parallel to the axis to pass radially into the core, where it sets up eddy currents, these being of much greater intensity than those due to the first changes of flux. The energy of the impulse given to the armature by the sudden load is dissipated as heat partly in the coil, but mostly in the core. The intensity of magnetic force when an alternating current is passed round a large solid iron core, is much greater at the circumference than the center. The heating effect is thus greater at the circumference, and the damping coil may be regarded as a device for concentrating the eddy currents in the outer layers of the core, increasing the rate of dissipation of energy. A simple mathematical theory of the damping coil is given. —Lond. *Elec.*, Sept. 27.

Self-Starting Single-Phase Motor Without Brushes.—Fischer-Hinnen.—A reply to the criticism, mentioned in the Digest, Sept. 7. He says that while the construction of his single-phase motor is similar to the Sahulka two-phase motor, the principles underlying both motors are essentially different.—*Zeit. f. Elek.*, Sept. 8.

References.

Short-Circuit Current of Three-Phase Machines.—Bauch.—A long mathematical article. At the start he remarks that the calculation of the short-circuit current of a three-phase machine always gives too small values. While this disagreement between calculation and measurement is often said to be due to straying, he says that while straying has certainly an important influence, there are other factors of importance. He describes in detail a method for calculating the field excitation for short circuit, the method being illustrated by many examples.—*Zeit. f. Elek.*, Aug. 4.

Generating Sets of Small Capacity.—An illustrated description of several small generating sets of French make; two generators of the Gramme Company, driven by gasoline engines and giving 18 amperes or 35 amperes at 110 volts; also similar generating sets of Dion and Bonton, etc.—*L'Ind. Elec.*, Aug. 25.

Dynamo Construction.—Schulz.—A review of improvements made in recent years in the method of construction of direct and alternating-current dynamos.—*Elek. Anz.*, Sept. 5, 8.

Generators.—Some important typographical errors in a former article on Oerlikon generators.—Lond. *Eng'ing*, Sept. 27.

Standardization of Electrical Apparatus.—Broderick.—A discussion of the advantages of standardization, from the point of view of the manufacturer. Quicker deliveries, less investment outlay, greater surety of satisfactory operation, lower cost of maintenance by reason of the readiness and cheapness with which renewal parts can be secured.—*Eng. Mag.*, Oct.

Lights and Lighting.

Direct-Current Arc.—Janet.—His long paper, read before the Internat. Soc. of Elec. in Paris, on an investigation of the direct-current electric arc, made in the Central Laboratory of Electricity by Laporte and Leonard. This investigation, which was a very extended one, dealt with the illumination obtained with different carbons under different electrical conditions. The apparatus used and the method of the measurements are described. The object was to separate the different influences which determine the resulting illumination. Carbons of a certain quality and of certain diameters were first experimented with under varying electrical conditions, the current being varied between 4 and 12 amperes and the pressure between 30 and 55 volts. After that the influence of varying the diameter first of the negative carbon and then of the positive carbon was investigated. After that the diameter of both carbons were varied together. Finally, carbons of different qualities were used. The results of their tests of the same carbons (cored 12 mm. and homogeneous 8 mm.) with varying current and voltage, are given in tables and diagrams. The curves obtained with constant current (4, 6, 8, 10, 12 amperes) show that the total luminous flux increases when the voltage is raised from 30 up, reaches a maximum at a voltage near 50 volts and then decreases again. The maximum total luminous flux for 12 amperes is about 8300 lumens (one lumen being evidently the flux in the unit solid angle emanating from one bougie or candle). They could not confirm Mrs. Ayrton's observation that the curve has a minimum after the maximum. The curves for lumens per watts, as function of the voltage, are also given. They are of the same general form, but reach the maximum at a lower voltage, about 41 volts. They also determined the consumption of the carbon and the form of the arc. Regarding the diameters of the carbons, they found that for an arc of given current, in order to get the maximum amount of light and the best efficiency, one should choose carbons of the smallest diameter which can be operated satisfactorily. The paper contains many tables and diagrams. It is concluded by some remarks on two arc lamps, and three arc lamps in series.—*Bull. Soc. Int. des Elec.*, June.

Arc Lamps.—Bochet.—A paper read before the Internat. Soc. of Elec. in Paris. Low-voltage arcs, i. e., for voltages between 35 and 38, give very good results with reference to steadiness and quantity of light, with specially prepared carbons. A current not lower than 2 amperes and not higher than 20 amperes should be used. For medium voltage arcs, i. e., for voltages between 38 and 50, it is convenient to increase the current together with the voltage. A French company uses 2 amperes for 36 to 40 volts, 8 amperes for 41 to 44 volts, 16 amperes for 44-47. For alternating-current lamps, a table is given, showing the system of French makers: 6-ampere, 27-volt, 9-mm. cored carbons; 16-ampere, 29-volt, 14-mm. carbons; 30-ampere, 30-volt, 20-mm. carbons. Enclosed arcs are said to be unsteady and to give no good light. The main advantage is the long life of the carbons. While it is much used in the United States, he thinks that Europe is justified in refusing the enclosed arc lamp on account of

the inferior quality of the light. The balance of the paper is a discussion of regulating devices. In the discussion which followed several speakers expressed an opinion in favor of the enclosed arc lamp.—*Bull. Soc. Int. des Elec.*, July.

Lighthouses in France.—De Rochemont.—A Glasgow Internat. Eng'ing Congress paper on "Recent improvements in the lighting and buoying of the coasts of France." The intrinsic brightness, in a horizontal direction, of various systems of lighting used in lighthouses, is given as follows, expressed in carcels per square centimeter of the mean horizontal focal plane of the luminous source: Burner with mineral oil and 1 to 6 wicks, 0.35 to 1.18 carcels; incandescent lighting with compressed oil gas, 2.00 carcels; incandescent lighting with patroleum vapor, 2.50 carcels; incandescent lighting with acetylene, 4.00 carcels; crater of the electric arc, 900 carcels; (one carcel equals 9.5 candles). A list of 13 French lighthouses is given, five are illuminated with oil, six with incandescent gas, petroleum or acetylene, five by the electric arc. Three of the latter have a single set of optical apparatus, two a double set. In those with a single set, three powers of light are used, produced by currents of 25, 50 and 100 amperes at 45 volts. In lighthouses with a double set of optical apparatus there are only two powers of light, produced by 25 and 50 amperes each. Twenty-five amperes are used only during very clear weather, while the two arcs of 50 amperes are almost in constant use, and absorb the whole power of the two dynamos employed. In order to have one machine in reserve and also to be able to couple up both machines and obtain two arcs of 100 amperes for use in thick weather, a new type of two-phase alternator of 5.5 kilowatts has been designed, the construction of which is described in detail. The old pattern of electric arc regulator which had only one rod for conveying the current, caused the carbons to burn unsymmetrically and to produce uneven shadows. To remedy this, a much lighter and more exact regulator with two symmetrical rods has been designed, which is described and illustrated.—Lond. *Engineering*, Sept. 20.

REFERENCE.

Street Lighting.—An experiment is described which shows that in comparing the light given out by lamps, one should not make an estimate from the apparent brilliancy, as it is very deceptive. Several accessories of street lighting, brought out by an English company, are described, especially a new device for raising and lowering arc lamps.—Lond. *Elec. Eng.*, Sept. 27.

Power.

Power Transmission in Coal Mines.—Habermann.—The first part of a paper read before the Electrotechnical Society, of Vienna. He remarks that the installation of electric power in coal mines should make good progress in the near future in Germany. In one district, that of Dortmund, there are at present 500 steam engines in operation, with a capacity of more than 500,000 horse-power, of which only about 20,000 horse-power are used for driving dynamos. While the direct-current system has been used in some special case and has been found quite satisfactory, the three-phase system is in general used for the larger plants, the three-phase induction motor being specially adapted for mines. He first discusses motors for driving pumps, the normal speed is given at 80 to 150 r. p. m. The squirrel cage type has not been found satisfactory. The use of slip rings for starting is no disadvantage. For low-speed motors he recommends a lower frequency than that which is generally used in Germany (50 per second) in order to make the motor cheaper and electrically better. He then discusses the electric driving of ventilators. Electric power should certainly be used for this purpose when a new mine is started. There is some difficulty with induction motors when the ventilator has to run at a higher speed in an emergency case. Electric drills have so far found no general application. He thinks the present commercial types are not yet sufficiently safe and convenient.—*Zeit. f. Elek.*, Aug. 25.

Power Plant.—A description of the power plant of a sugar refinery near Tangermuender. The three-wire direct-current system is used for lighting, while for power purposes the three-phase system at 200 volts is used. There are more than 70 induction motors, with capacities up to 40 horse-power. The plant furnishes current for lighting the city of Tangermuender, which is at a distance of a mile. For transmission, the voltage of the three-phase currents is raised to 2000. It is converted to 240 volts direct current in the city in a sub-station by motor-generators. There is also a storage battery.—*L'Elec.*, Aug. 24.

Traction.

New York.—Vreeland.—An article on the organization of the Metropolitan Street Railway Company, of New York. Twelve years ago the street railways in the boroughs of Manhattan and the Bronx were operated separately by some 18 different companies. They have gradually become consolidated until now the property consists of about 760 km. of track, and all are under one control. In 1893 4000 men were employed, now there are more than twice as many. The effect of the consolidation has not been to curtail the number of employes, but has largely reduced the number of higher officials. The writer then gives a diagram showing the division of authority among the officials of the company. Each of the officials has practically absolute control in the department under him.—*St. R'y Jour.*, Oct. 5, and Int. Ed., Oct.

Metropolitan Street Railway Power-Plant.—Starrett.—An illustrated article on this plant in New York City, which is the largest polyphase electric railway power plant now in operation and also the largest electric railway power plant of any kind. The generators are also the largest yet put in operation. The evolution of power house construction in the United States in the past ten years is briefly reviewed. The use of polyphase current for railway distribution in the United States was for several years limited to location where power was furnished by a distant waterfall, and where polyphase current offered the only economical means of transmission. The first extensive use of polyphase distribution was in England, where the regulations as to drop in the ground return circuit were very strict. In the United States direct-current plants had already been erected in most of the large cities before polyphase machinery came into use. In New York, however, extensive electric railway construction was not begun until polyphase machinery had reached a high state of perfection. The various elements which go into construction of a direct-current power house as compared with a polyphase power house are then discussed. The ground space occupied by the Metropolitan power house is much less than that of any other electric railway power house in the United States per kilowatt of output. For example, the space required per kilowatt of capacity in this plant is .68 square feet in the engine room, and .56 square feet in the boiler room. There are very few power houses that do not take more than twice this engine room ground space, and five times this amount is not uncommon. This is due to the use of large 3500 kilowatt units, as much greater capacity can be put in a given ground space with a larger unit. The liability to interruption to the service through accident to any part of the power house or distribution system is guarded against by dividing the power house into a number of independent divisions. These are usually operated in connection with each other, but can be separated. The feeders from the power house also come in from several different directions. The operation of the power house is still in an experimental stage because of its newness. There are now 180 men employed in the power house, in which there are running eight 3500-kw generators. A list of these men is given in detail with the duties of each. They work in three shifts of eight hours each. In the seven sub-stations 60 men are employed. The coal consumption in actual practice is 2.65 lbs. per kilowatt-hour. The efficiency between the engine cylinders and the switchboard is above 90 per cent.—*St. R'y Jour.*, Oct. 5, and Int. Ed., Oct.

Brooklyn.—Roehl.—An illustrated article on the power stations and distribution system of the Brooklyn Rapid Transit Company. Owing to the great demands on the power supply, the Brooklyn Heights Railroad Company is about to double its generating capacity. An increase of 36,000 horse-power is to be made to the system. The general distribution of the initial power will be by high-tension polyphase feeders, a radical change from the present installation which is all of the direct-current, 550-volt type. The high-tension distribution is to be made by triplex, paper insulated, lead-covered cables placed in terra-cotta ducts under the streets of the city. The new station will contain at first six 4000-hp direct-connected generating units, two of which will be for supplying the district in the immediate vicinity of the station and will furnish direct current at 550 volts, the other four units will be 4000-hp, three-phase, 25-cycle revolving-field type generators. In one of the other stations now running will be installed a direct-current unit of the same size and type as that in the new station, and this will make, with two additional units for which space is left in the new station, a total capacity of 36,000 horse-power for the additions.—*St. R'y Jour.*, Oct. 5, and Int. Ed., Oct.

Third-Rail System.—Hoopes.—A paper read before the N. Y. State St. R'y Ass. on third-rail interurban railways. The third-rail sys-

tem is preferable to the overhead trolley on roads where its use is possible, for the following reasons: Lower cost of construction, very greatly lower maintenance cost, and more reliable operation due to the absence of delays caused by trolleys leaving the wire and wrecking sections of the line. He gives a table of comparative cost of 80-lb. third-rail and equivalent trolley construction for one mile of track. It is $3,410 for the third-rail system against $4,421 for the trolley system. The danger of the third rail is exaggerated. It is undesirable to install the third rail between the track rails, the best location for it is outside of one of the track rails and elevated several inches. The conductor rail should be of a special mixture, giving the highest possible electrical conductivity. In his experience the following composition of steel has proved satisfactory: Carbon, 0.09 per cent; manganese, 0.44 per cent; phosphorous, 0.088 per cent; sulphur, 0.08 per cent. This rail gave a resistance of 12.9 microhms per c. c., and was consequently of about 7.25 times the resistance of commercial copper. The mixture can be improved upon by further decreasing the carbon and other alloying elements. Although the operation of the third-rail system seems to be extremely satisfactory under nearly all conditions, it becomes very difficult in a sleet storm. There is as yet no approved method of removing the sleet from the rails.—*St. R'y Rev.*, Sept.; *St. R'y Jour.*, Sept. 14, and Int. Ed., Oct.

German Convention.—An account of the proceedings at the recent annual meeting of the Association of German Tramway and Light Railway Companies. An investigation had been made by the officials into alleged troubles with electrolysis in different cities. A list of questions was sent to 107 gas and water companies asking if there had been any damage caused by return circuits. The replies showed that his had occurred in only two or three out of 90 cities, and here the trouble had been slight. Fromm read a paper on brakes, an abstract of which is published. Poetz read a paper on safety appliances for electric railway cars, in which he discussed the value of fenders. He believed that the wheel guard which is from 7 to 8 cm. above the pavement to be the most desirable type of fender. A paper was read by Sieber describing economies effected on his line. He referred to the necessity of a well regulated storehouse and the issue of material from there should be only by requisition. Coal should be frequently tested and its heating value ascertained. The brick work of the boiler room should be inspected every three or four weeks. Shut downs in the boilers should not be caused too frequently, as it means a consumption of from 1000 to 1500 kg. of coal. The doors and windows of the engine and boiler rooms should be kept closed at night to avoid wasteful radiation of heat. The use of two voltages or the three-wire system is recommended. The cars should be tested to see that they operate easily. A single truck after receiving a slight push should travel over a level distance from 100 to 200 meters. Wheels should be properly mated and a pair of wheels should not differ in diameter more than 0.1 mm. A paper was read by Roehl on the training of motormen. He believed that former horse car drivers made the best motormen, and that a training of from 8 to 10 days was sufficient for this kind of employe. A considerable amount of theoretical knowledge is a bad thing, as the motorman will attempt to make repairs on his own car. Secretary Vollguth read a report on accidents, and showed that there had been a decrease in certain classes of accidents and an increase in others. He believed that the best fender was a wheel guard. He then presented some statistics on the German street railways compiled at the request and at the expense of the Government. The next meeting will be held in 1902 at Duesseldorf.—*St. R'y Jour.*, Int. Ed., Oct.

REFERENCES.

Jungfrau Three-Phase Railway.—A very long and profusely illustrated article on the electric equipment of the Jungfrau Railway.—*L'Ind. Elec.*, Sept. 25.

Chicago—Joliet.—An illustrated description of this new interurban road. Current is supplied from a motor power plant in Joliet. High-tension three-phase currents are transmitted, the transmission line being of aluminum. There are three converter sub-stations for converting to 550-volt direct current. They are provided with storage batteries.—*West. Elec.*, Oct. 5.

Surface Contact System.—BAINVILLE.—An illustrated description of the Schuckert contact system which is in use in Munich, as has been noticed before in the Digest.—*L'Elec.*, Sept. 7.

High-Speed Electric Railways.—REYNOLD-SCHILLER.—The continuation and conclusion of his long serial, in which he gives the following final result: "There is no doubt that the problem, how to build high-speed electric railways, can be solved in the most economical way by the broad gauge of 4500 mm." (14.76 ft.).—*Zeit. f. Elek.*, Aug. 11, 18.

N. Y. St. R'y Assoc.—The papers, read before the New York State St. R'y Ass. are published in *St. R'y Jour.*, Sept. 14, 21, 28.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Efficiency of Alternating-Current Plants.—WEYDE.—A very long article in the problem of improving the efficiency of alternating-current plant, the efficiency being defined as the ratio of the energy used by the consumers to the energy generated in the station. From statistics of German central stations it appears that 65 per cent of the direct-current stations have an efficiency of more than 75 per cent, while only 10 per cent of the alternating-current plants have the same efficiency. For the other 90 per cent of plants the efficiency is between 75 and 50 per cent, and average 65 per cent. It is to be considered, however, that distances are generally much larger in alternating-current systems. It has been tried to improve the comparatively low efficiency of alternating-current plants by giving up the "house-to-house" system with transformers in the consumers' premises, and by introducing instead the "bank" system with transformer sub-stations supplying low-tension networks, as in the latter system the no-load loss in transformers is smaller and less kilowatts of transformer capacity is required. He shows, however, from statistical data that no great improvement of efficiency of the system is obtained by introducing the bank system for the house-to-house system, and that in those cases where a marked improvement has really been accomplished, it has been due to the fact that in these cases unloaded transformers were disconnected from the network. He concludes that the only effective way of improving the efficiency of a plant is to use automatic switches for disconnecting the transformers. He discusses the following types of switches: Mueller, Electric Selector & Signal Company, Walton, Schlatter. He believes that only the Schlatter system is of commercial value. It is described in detail and illustrated by several diagrams.—*Zeit. f. Elek.*, Sept. 15, 22.

Pilot Wires.—PICOU.—An illustrated article on "Pilot wires and the regulation of the voltage in central stations." All the pairs of pilot wires are connected in parallel across a pair of bus-bars. An electrometer on a high resistance electromagnetic voltmeter, connected across these bus-bars, gives directly the average voltage of the various pairs of pilot wires. A hot-wire voltmeter having a relatively low resistance is not suitable for this purpose. The voltage for each pair of pilot wires is most conveniently measured by means of ammeters inserted in the pilot wires as from their indications the excesses of the single voltages above or the amount below the average is easily found.—*L'Ind. Elec.*, July 10.

REFERENCES.

High-Tension Switches.—Abstracts of the papers presented to the Pac. Coast Elec. Transmiss. Ass'n by Masson, Van Norden, Lee, McFarland, Currie, Hebgen, on electric switches and fuses for high-voltage currents, and of the discussion which followed. The subject is also discussed editorially.—*Eng. News*, Oct. 3.

Walthamstard.—An illustrated description of this British municipal electric station, which is of interest as gas engines are used for driving the dynamos. There are three 66-kw direct-current dynamos and a battery of 284 cells.—Lond. *Elec.*, Sept. 27.

British Plant.—An illustrated article on the Battersea electricity supply work. The three-wire system with 2 by 230 volts is used. The capacity of the plant is 900 kilowatts.—Lond. *Elec.*, Sept. 27.

WIRES. WIRING AND CONDUITS.

Aluminum.—WILSON.—A British Ass'n paper on "The commercial importance of aluminum." He discusses the progress in manufacture, the construction of the Heroult cell, the properties of aluminum alloys, light alloys and heavy alloys, the use of aluminum for electric conductors, aluminum wires under wind pressure, the skin effect, electric glow, joints for aluminum wires, melting and casting, the addition of aluminum to iron and steel, rolling and forging, hardening and annealing, drawing and stamping, and the use of aluminum for various commercial purposes. Aluminum containing .31 per cent Fe and .14 per cent Si has a specific resistance of 0.00000259 legal ohms at 0 deg. C. (evidently referring to one cubic centimeter) and 0.000002762 legal ohm at 15 degs. C., a temperature coefficient 0.00393 and linear coefficient of expansion 0.000023 between 16 degs. and 100 degs. C. When in the form of wire .126 inch (3.2 mm.) in

diameter, it has a breaking load of 28,200 lbs. (12.6 tons) per square inch, a limit of elasticity 19,376 lbs. (8.65 tons) per square inch, and percentage extension 0.19 within the limits of elasticity with an applied force of 16,250 lbs. (7.2 tons) per square inch. Alloying this aluminum with copper, zinc, nickel, or iron in varying proportions to the extent of about 2 per cent, increases the tensile strength at the expense of conductivity. It is therefore important to know what the tensile properties have to be in particular cases. Some data are given regarding the aluminum wires used by the Standard Elec. Co., of California. The tensile properties of aluminum are increased by rolling, hammering or drawing. In testing wires, therefore, different results may be obtained from the same meterial by varying the amount of drawing down. Mechanical joints have been used for aluminum wires with success in practice; but, with proper precaution, aluminum wires can be welded either by the use of the blow-lamp or electrically. The results of a test are given in which the original trolley wire (8 section) had an aera of 0.135 square inch and a breaking load of 1.6 tons on that section, with 11.3 per cent extension. The welded joint gave 1.2 tons breaking load, with 8 per cent extension, the joint not being broken. An aluminum wire, 0.516 inch in diameter, having a breaking load of 3449 lbs. with 14 per cent extension, gave 2912 lbs. breaking load, when welded with 20 per cent extension. Hard and soft solders are said to be supplied by the Brit. Al. Co. It is necessary to break up the oxide which forms on the surface of the aluminum, and with care aluminum soldering is rendered easy. In the discussion which followed, Preece said that if all the merits claimed for aluminum were well founded, it would be of immense service for extending telegraphs through new countries, as the saving of weight in transportation is of the greatest importance; but up to the present, trials with telegraph wires of aluminum have not been successful as the thin wire, commercially made, was not uniform in its texture and did not withstand the strain of air pressure like iron or copper, but he regards this to be entirely a defect of the manufacture.—Lond. *Eng'ing*, Sept. 27.

Electro-Physics and Magnetism.

Magnetic Tests of Iron.—Gumlich and Schmidt.—A long account with tables and diagrams of an extended series of magnetic tests, made in the German Reichsanstalt, of different kinds of iron. They first investigated the influence of annealing upon the magnetic properties. The maximum temperature was 950 degs., the time of heating and cooling three days. The magnetic properties of soft wrought iron are not changed greatly by annealing. The magntic properties of cast iron are improved by the first annealing, while repeated annealing seems to deteriorate them again slightly. By the first annealing, the coercive force (i. e., half the width of the hysteresis loop on the X axis) is reduced to one-third, the hysteresis loss to less than one-half, the remanence (i. e., half the height of the hysteresis loop on the Y axis) increases by 10 per cent. The results of annealing upon the magnetic properties of cast steel depend largely upon the individual constituion of the material. In general, annealing gives good results. While the values of the remanence vary in an irregular manner, sometimes increasing and sometimes decreasing, the coercive force diminishes and the maximum permeability increases, both values reaching a limit after the second or third process of annealing. The hysteresis loop also decreases with repeated annealing and is reduced to one-half with some materials. Other results were obtained with dynamo sheet iron for armatures which has been generally annealed before. Two kinds were tested, both were improvd in all their magnetic properties by the first process of annealing while the second process deteriorated these properties again. This deterioration was found to be due not to the formation of an oxyde layer on the surface, but to molecular changes. Such sheets for dynamo armatures were found to be very sensitive against mechanical treatment, as grinding or rubbing, so that the authors doubt whether the magnetic properties determined by tests of the sheets before they are made up in the armature, are still valid afterwards in the armature. Solid iron rods were not sensible to mechanical treatment. They investigated whether the process of annealing is best done with the iron sample in iron filings, sand or charcoal, or in air. Great differences were not found, but the cover of sand was found impractical on account of the formation of clinker. The cover of iron filings seems to give the best results. They further investigated the influence of the process of annealing upon the electric conductivity. As the eddy current loss increases with the conductivity, the best iron would be that which has a minimum hysteresis loss and a maximum electric resistance. It was found that in general annealing increases the conductivity, but not to such a degree that this disadvantage would balance the advantage due to the improvement of the magnetic properties. By comparison of a great many tests, it was found that in general the greater the hysteresis loss the greater the electric resistance, the greater the remanence the greater the coercive force and the smaller the maximum permeability. But this rule holds good only in general, while several materials greatly differed from this rule. One special material which compared with the other materials tested, had relatively very good magnetic properties, and was found to have an electric resistance of about three times the average resistance of all other samples. The chemical constitution of this material is not given, as it was communicated confidentially to the Reichsanstalt. But this shows that it is possible to obtain iron with very good magnetic properties, and at the same high electric resistance. Further experiments of the authors deal with the determination of the coercive force and with the maximum permeability. They found the following empirical formula for all values in c. g. s. units. The maximum permeability is equal to the ratio of remanence and coercive force, multiplid with a factor which is in general a linear function of the coercive force, but is approximately 0.5 for soft iron and cast iron.—*Elek. Zeit.*, Aug. 29.

Electrolysis of Alkali Salt Vapors.—Wilson.—A brief abstract of a Brit. Ass'n Adv. Sc. paper, giving the result of experiments which show that Faraday's laws of the electrolysis of liquids are applicable to the vapors of alkaline salts. Experimenting with a large number of salts, and injecting the aqueous solutions of the salts into a blast of air between the two electrodes, he found that the product of the electro-chemical equivalent of the ions into the maximum current which could be passed at any voltage whatever through the vapor was always a constant equal to 0.0276.—Lond. *Elec.*, Sept 20.

Reference.

Speaking Arc.—Janet.—A brief illustrated paper, read before the Int. Soc. of Elec. in Paris, on experiments made by Leonard with the speaking arc, and especially with the arc used as telephonic transmitter.—*Bull. Soc. Int. des Elec.*, July.

Electro-Chemistry and Batteries.

Calcium Carbide Manufacture.—Pradon.—An article on "The influence of the nature of the electric current on the manufacture of calcium carbide." Under precisely similar conditions of the furnace, and with the identical charges, direct-current carbide is of lower quality than that prepared with alternating current. Direct current yields a compact carbide which is very difficult to break; alternating current produces a crystalline carbide which breaks more readily. The furnace charge should be absolutely homogeneous in composition when direct currents are used. With alternating currents a rough mixing is quite sufficient. With alternating currents the influence of the phase difference must be taken into account. The power factor of the furnace may be 0.8. Pradon has designed a furnace built according to the idea which underlies the use of concentric cables for alternating currents. The hearth of the furnace is, as usual, a track running on wheels, and its sides are constructed of metallic walls. When in position, the truck stands under a metallic chimney, through which the gases ultimately pass off, and in the middle of which hangs the vertical electrode. One lead for the current is attached to the top end of the furnace sides. The other is fastened to the lower end of the chimney. The current is thus compelled to pass downwards through the metallic sides of the furnace, into the central hearth, up through the mixture of lime and coke, up through the second electrode, down through the walls of the chimney, and then to the main, so that in every position the central current is opposed by an "annular" current always traveling in the opposite direction. He claims that considerable economy can thus be effected in the generating plant, as an alternator may be safely used, the dimensions of which have been calculated for a power factor of 0.85. If, however, the lag of the furnace has not been eliminated, it is necessary to use in calculation a power factor of 0.70. If the proportion of lime is increased, the production of gas is diminished and the output of carbide is raised. It seems possible that there are advantages in producing a lower grade of calcium carbide than is made at present, a material yielding only 250 litres of gas per k. gr. for in which the manufacturing costs, and therefore the selling costs, might be more than proportionately reduced. He thinks that a "resistance" furnace cannot be used for making calcium carbide.—*Zeit. f. Calciumcarbid Fab.;* abstracted at some length in Lond. *Elec. Rev.*, Sept. 20.

Platinum Electrode.—A description of a new platinum electrode, made by Heraeus. A vertical glass tube, closed at the bottom, contains copper wires which are connected at the top to a lug of copper. Several horizontal thin platinum wires are fused through the walls of the glass tube; inside the glass tube they are soldered to the vertical copper wire; outside the glass tube very thin sheets of platinum, of only 0.0075 millimeter (slightly less than 0.3 mil) thickness and generally of 20 mm. (0.8 inch) breadth, are fused to the horizontal platinum wires. It is claimed that the latter give an unexpectedly strong rigidity to the thin platinum sheets. One square decimeter platinum electrode, i. e., 2 square decimeter of surface, weighs only 2 grams, hence 1 square meter surface weighs 100 grams (1 square inch surface weighs 0.0023 ounce). The arrangement of the platinum electrode causes an equal distribution of the current over the surface. The whole platinum electrode is somewhat like a combination of several electrodes which receive their current through the horizontal platinum wires from the thicker copper wires inside the glass tube. It is claimed that the glass tube with the platinum wires fused through the walls can be made strong and durable, even for use in hot solutions. It is believed that the new electrodes can compete with carbon electrodes in price, so that platinum may be used in electrolytic processes for which it has so far been assumed to be too expensive.—*Fly-leaf in Elektrochem. Zeit.*, Sept.

Nickel Plating.—An illustrated article on the process of nickel plating in which the objects to be plated are placed in a revolving drum. A device of Delval and Pescalis is described, by which the radial conductors in the drum which connect the objects to be plated to the negative pole of the source of current, are connected to this pole only as long as they are in contact with the objects to be plated, and otherwise are disconnected. This is accomplished by a special commutator which connects only a part of radial conductors at one time to the negative pole.—*L'Elec.*, Aug. 17.

Zinc Lead Cell.—A note on the regeneration of the lead electrode of a discharged zinc, sulphuric acid, peroxyde of lead cell. It is suggested by Hofmann to regenerate (oxidize) the discharged lead plate chemically by means of hypochlorous acid, which is said to be preferable to other oxidizing agents.—*L'Ind. Elec.*, Aug. 25.

REFERENCES.

Union Storage Battery.—A. Z.—An illustrated description of the Union storage battery which is made by a French company. The negative plates are made of the Faure type, the positive plates of the Plante type. The manufacture of the positive plates is described in detail. It is built up of a large number of laminæ by means of a special machine. No numerical data are given regarding the operation of the cell.—*L'Ind. Elec.*, Sept. 10.

Electro-Chemistry.—JONES.—The conclusion of his serial on selected chapters in electro-chemistry, in which he gives a review of the principal views of the electrolytic dissociation theory. The concluding part deals with Nernst's theory of calculation of the e. m. f. of cells.—*Elec. Rev.*, Oct. 5.

Electro-Chemical Micrscopy.—R. KOHN.—He suggests a new method of research, specially applicable to plant physiology. "He proves that all vegetable cells show p. d.'s which regularly appear in the course of the cellular activity." All plants are pervaded by a connected system of electric—probably electrolytic—conductors.—*Pamphlet*, Mercy, Pray; abstracted in Lond. *Elec.*, Sept. 20.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Plotting Alternating-Current Waves.—HOSPITALIER.—His illustrated paper in full, read before the Int. Soc. of Elec. in Paris on some applications of the stroboscopic method to the study of alternating currents, on the arcoscope and ondograph. Besides the ondograph (Digest, Aug. 31), and his special device for registering instruments (Digest, Oct. 5), he describes the following instrument which is called the arcoscope and is to be used for studying the variations of brightness which an alternating-current arc undergoes during a period. Upon the axle of a small induction motor, supplied by the same current as the arc, an opaque disk is mounted, provided with a number of small slits, equal in number to the pole pairs of the motor. For a four-pole motor the disk has two slits. The light of the arc is sent through the slits of the disk and is projected through a lens on a screen. The picture of the arc is thus taken for one instant in each period, and as the induction motor has a small slip, the picture is taken in consecutive periods at slightly different phases.—*Bull. Soc. Int. des Elec.*, July.

Silver Voltameter.—SKINNER.—An abstract of a paper, read before the Brit. Ass'n Adv. Sc., on a "Comparison of the deposits in silver voltameters with different solvents. He experimented with two voltameters, one containing the usual aqueous solution of silver nitrate, and the other a solution of this salt in piridin. He found that the electro-chemical equivalent of silver as obtained from the aqueous solution differed from the piridin solution about the same amount as the difference obtained between electrolyzing under atmospheric pressure or in vacuum. In effect, the true electro-chemical equivalent of silver has to be raised from 0.1118 to 0.1119. In the discussion which followed, Griffiths regarded piridin to be a better solvent on account of the smaller risk of removing any of the deposit by subsequent washing, the deposit being harder and more consistent. Threlfall advocated the use of fused salts in preference to solutions. Schuster pointed out that the voltameter is intended to give, not an absolutely accurate standard but a sufficiently close approximation to the values obtained by absolute measurements. Lord Kelvin advocates the use of copper in place of silver, employing Gray's method and formula, with a current density of 0.02 amperes per square centimeter. Murray spoke of having used zinc with satisfactory results, and Quincke said that in Germany the copper voltameter is extensively used and is found to be satisfactory.—Lond. *Elec.*, Sept. 20.

Measuring the Resistance of an Electrolyte.—DUDDELL.—At the end of his paper on the resistance and e. m. f. of an electric arc (see the abstract above under Lights and Lighting) he deals with Kohlrausch method of measuring the resistance of an electrolyte. While it is often assumed that the errors due to polarization are avoided if the frequency of the alternating or interrupted current used is as high as a few hundred p. p. s., he found experimentally with a sulphuric acid cell that it was not until the frequency exceeded 10,000 p. p. s. that the electrolyte behaved as a dead resistance, and the errors due to the polarization were avoided. If the resistance of this cell were tested in the ordinary way at a frequency of 100 p. p. s., the value obtained would be over twice its true resistance. It is concluded that unless other methods are adopted to eliminate the effects of polarization, it must not be assumed that the use of alternating currents of ordinary frequencies of a few hundred p. p. s. eliminates the possibility of errors due to polarization.—Lond. *Elec. Rev.*, Sept. 20.

Interrupter.—SOULIER.—An illustrated description of a new high-speed interrupter for Ruhmkorff coils. In principle the apparatus is a commutator of two copper segments, with two carbon brushes. The current enters through one brush and leaves through the other. The circuit is broken as long as both brushes are not sliding on the same segment. One of the brushes can be displaced at will, which enables one to adjust the time during which contact is made, in relation to the time during which the circuit is broken. The construction of the apparatus for practical uses is described in detail and illustrated.—*L'Ind. Elec.*, Sept. 10.

REFERENCES.

Meters.—Illustrated descriptions of two new French energy meters, one for alternating current, the other for direct current. The Blathy-Japy alternating-current meter is of the rotary field type. All parts of the meter through which currents flow, are fixed; the movable part is a simple homogeneous disk. The Japy direct-current meter consists essentially of an electrodynamic motor, the field coils of which are supplied with the main current, while the movable coils are shunted across the line wires.—*L'Ind. Elec.*, Aug. 10.

Prepayment Electric Meter.—BAINVILLE.—An illustrated description of a prepayment device, brought out by a French company, to be used in combination with any type of electric meter.—*L'Elec.*, Sept. 14.

Meters.—TURNER.—An Ohio Elec. Light Ass'n paper on the selection and maintenance of meters.—*West. Elec.*, Sept. 28.

Motor Meter.—An illustrated description of the Raschke motor meter for direct current.—*Zeit. f. Beleucht*, Sept. 20; *Elek. Anz.*, Sept. 1.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telegraph Lines.—MEDINA.—Long-distance telegraph lines consist of component circuits added together through repeaters. Where the parallel wires are few and far apart on the cross-arms the compound circuits work well with few repeaters. When new wires are added on the same poles, the mutual induction becomes more and more troublesome. He discusses the nature of mutual induction and distinguishes between that which takes place between the primary

and secondary coils of a transformer, and that which occurs between the two plates of a plane condenser. The former is electromagnetic induction, the latter electrostatic induction. He gives reasons why he believes that in telegraph lines the electromagnetic effect is usually negligible compared with the electrostatic effect. Being statical in its nature, the mutual induction effect is a function of the e. m. f., and not of the current, so when it becomes necessary to decrease it, it has to be done by decreasing the e. m. f. This may be done by using larger or shorter wires. The latter course requires the introduction of more repeaters, which he advocates. He calls attention to the importance of the time of movement of the relay lever. This is cut down by using shorter circuits. In certain classes of multiple telegraphy, relays with extra heavy levers and armatures are used, which can only increase that movement-time of the relay levers to the detriment of the signals.—*Jour. of Elec.*, Aug.

REFERENCES.

Statistical.—Long statistical tables on telephony in 1899, for nearly all countries of the earth. The United States, however, is not included.—*Jour. Tel.*, July 25.

Statistical articles on telegraphy and telephony in Sweden in 1900, on telephony in Brazil in 1898, and on telegraphy and telephony in the Netherlands in 1899.—*Jour. Tel.*, Aug. 25.

Statistical articles on telegraphy and telephony in Switzerland in 1901; in British India during 1899-1900; in Dutch Indies in 1899, and in Great Britain during the year from April, 1900, to March, 1901. —*Jour. Tel.*, Sept. 25.

MISCELLANEOUS.

Lightning Rods.—HEDGES.—A Brit. Ass'n paper on protection from lightning. He gives an account of his rearrangement of the system used at the St. Paul's Cathedral. The number of ordinary conductors from air to earth has been greatly increased, and, besides these, horizontal cables are run on the ridges of the roofs and in other prominent positions so as to encircle the building, being interconnected to the vertical conductors wherever they cross one another. The horizontal cables are furnished at intervals with aigrettes or spikes, which are invisible from the ground level and designed to give many points of discharge.—Lond. *Elec. Eng.*, Sept. 27; abstracted in *Eng'ing*, Sept. 27.

Association of German Electrical Engineers.—A full account of the proceeding at the recent annual meeting of this society in Dresden. (The papers read there have been noticed in the Digest as far as published.) The following values were adopted provisionally for one year and will be voted on again definitely next year: Standards for rating and testing electric machines and transformers (Digest, July 13, Sept. 28), rules for determining the magnetic properties of sheet iron (Digest, July 20). The following regulations were definitely adopted; safety regulations for electric railway installations, standards for rubber insulated wires, and rules for the protection of buildings against lightning flashes. All these regulations are reprinted in full. The president of the association is Professor Hartmann, of the firm of Hartmann & Braun, Frankfort.—*Elek. Zeit.*, Sept. 12, 19.

REFERENCE.

Electric Heating Apparatus.—HAERDEN.—An illustrated article in which he gives practical hints on making, with simple means, heating and drying apparatus for laboratory uses.—*Elek. Anz.*, Sept. 5.

New Books.

INTRODUCTION TO PHYSICAL CHEMISTRY. By James Walker, D. Sc., Ph.D. London: Macmillan & Co. 335 pages, 47 illustrations. Price, $3.

This book is intended to be an introduction to physical chemistry for students of chemistry. As the author remarks in the preface, his book makes no pretension to give a complete or even systematic survey of physical chemistry—its main object is to be explanatory. He has found in the course of 10 years' experience in teaching the subject, that the average student derives little real benefit from reading the larger works; that he keeps his everyday chemistry and his physical chemistry strictly apart, with the result that instead of obtaining any help from the new discipline in the comprehension of his systematic or practical work, he merely finds himself encumbered with an additional burden on the memory, which is to all intents and purposes utterly useless. This state of affairs the author has endeavored to remedy in the present volume by selecting certain chapters of physical chemistry and treating the subjects contained in them at some length, with a constant view to their practical application.

It must be conceded that the purpose and the general idea of the book are excellent, that the chapters treated by him are well selected, and that, in general, the treatment is extensive enough to give the student a good general idea of the theory, and at the same time interesting enough to excite the student to further studies. The contents of the 27 chapters are as follows: Units and standards of measurement; the atomic theory and atomic weights; chemical equations; the simple gas laws; specific heats; the periodic law; solubility; fusion and solidification; vaporization and condensation; the kinetic theory and Van der Waals's equation; the phase rule; thermo-chemical change; variation of physical properties in homologous series; relations of physical properties to composition and constitution; the properties of dissolved substances; osmotic pressure and the gas laws for dilute solution; deductions from the gas laws for dilute solutions; methods of molecular weight determination; molecular complexity; electrolytes and electrolysis; electrolytic dissociation; balanced actions; rate of chemical transformation; relative strengths of acids and bases; equilibrium between electrolytes; application of the dissociation theory; thermo-dynamical proofs.

It will be seen that the greater part of the book is of interest chiefly to chemists rather than to electricians. For the electrician, however, those chapters which deal with the principle of modern electro-chemistry and with the theory of the electrolytic dissociation are of special interest. It is therefore to be regretted that the author has not been very successful in the very chapter in which he discusses the fundamental researches on the processes occurring in the electrolytes during electrolysis, namely the work of Faraday, Hittorf, and Kohlrausch (Chapter 20). While the purely chemical points are very well brought out, this is not the case to the same degree with the electric phenomena. In the discussion of Faraday's law it would have been well to have shown clearly how the expression of Faraday's law as generally found in textbooks agrees with the assumption of charged ions. The textbooks generally state Faraday's law in the form, that the quantity of electrolyte decomposed in milligrams is 0.0104 times the number of ampere-seconds, times the chemical equivalent. The theory of ions says that a monovalent gram ion is charged with 96,500 coulombs of positive or negative electricity. The author of the present book starts at once with the latter statement, without mentioning the former. The student who makes an experimen in electrolysis will prefer the former statement, as given in the ordinary textbooks, because he can apply it at once to his experiment; he will be liable to regard the assumption of charged ions as something entirely different or as an irrelevant term of theorists. Such a book as the present one is intended to be, should show clearly that those two statements are in reality only different expressions of exactly the same thing. This can be done in a few lines, and should be done, as it is just in a book of this kind that the student looks for such explanations. Nor would it be too much to claim, too, that in this connection it should have been repeated that a coulomb is only another name for an ampere-second, for the book is for beginners and for chemists.

After the exposition of Faraday's law, the author discusses on a little more than four pages Hittorf researches on transport numbers, the discussion being clear, concise and to the point. After this follow some remarks on Kohlrausch's researches on the migration velocity of ions, which are very brief and not at all clear. He gives a table of the absolute velocities of migration with speeds in centimeters per hour, "when the difference of potential between the electrodes is one volt"; this is, of course, quite wrong. It would be easy to improve this chapter in a subsequent edition.

The last chapter of the book, which is on thermo-dynamical proofs, is of special interest. He there gives in concise and clear form some of the more important applications of the second principle of thermo-dynamics to the theory of solutions. The chapter is concluded by some remarks on electrical and chemical energy. By a simple cyclic process—which is a good example of the application of the entropy principle to chemical systems—he develops Helmholtz's formula for the relation between the e. m. f. of a cell, the heat equivalent of the chemical action in it, and the temperature coefficient of the e. m. f., i. e., the modified Thomson's rule. As is well-

known, Helmholtz has developed this formula as a consequence of his theory of the "free energy" of a system; it may also be easily obtained from other general statements of the entropy principle. But, in the opinion of the reviewer, the only proper way to dvelop it in a form intelligible and convincing to the beginner, is the way which the author of this book has used, to devise a special cyclical process and to apply to this process the old Carnot-Clausius principle, in the same way as it is applied to the heat engine. While improvements in details are very desirable, it may be said again that, as a whole, the book accomplishes its purpose, and can be highly recommended.

DENTAL ELECTRICITY. By Levitt E. Custer, B. S., D. D. S. Dayton, Ohio: U. B. Publishing House. 531 pages, 208 illustrations. Price, $4.

This is a book written by a dentist for dentists who seek to become acquainted with the nature and use of electric appliances used in dentistry. It is entirely practical in its style, and simple in its treatment. The book is well illustrated, and the subject is well covered. The first chapter is devoted to an outline of the theory of electricity. Then follows a chapter on electric terms. Next a chapter on magnetism. Chapter IV. deals with sources of electricity. The remaining eight chapters deal with practical applications of the current and are entitled, respectively, "The Rheostat," "Power," "Heat," "Light," "Electrolysis," "Cataphoresis," "X-Ray" and "An Independent Plant." Dentists employ small motors for driving their machines and tools, electric heaters for ovens and cauteries, electric lamps for illumination, electrolytic devices for therapeutical treatment, plating and cataphoresis, besides Röntgen ray apparatus. This represents a large and varied assortment of electric apparatus.

From a purely electrical standpoint the book is not without errors; for example, a dynamotor is described as a motor-dynamo, a totally different piece of machinery. But considering the necessarily popular treatment of the subject, and that the theory is properly subordinated to the practice, it would be unreasonable to expect the same degree of electro-technical accuracy that a college text-book should possess. The book will undoubtedly be of great value to dental surgeons.

De Laval Steam Turbine.

The De Laval steam turbine is now being introduced into this country, an American company having been formed for that purpose under the name of the De Laval Steam Turbine Company. A factory for the construction of turbines has just been finished at Trenton, N. J., and offices of the company have been opened at 74 Liberty Street, New York.

As is quite well known, the De Laval type of steam turbine was the first steam turbine to enter into the practical stage, the first machine having been put in use in 1883. At present thousands of these machines are at work in Europe, varying in size from 3 to 300 horsepower.

This turbine is, briefly, a steam impact wheel very similar in principle to the well-known Pelton waterwheel so largely used in the West under great heads. The steam impact wheel was first proposed by Branca, but its advantages were not practically realized until De Laval applied his diverging nozzle and mounted the wheel on a flexible shaft. By the use of the diverging nozzle it is claimed that a complete adiabatic expansion of the steam is obtained, and its entire static energy converted into kinetic energy. The flexible shaft overcomes the impossibility of producing a wheel accurately enough balanced to revolve about its center gravity at a velocity sometimes of as high as 1550 ft. per second.

By the use of the De Laval nozzle a volume of steam of a maximum pressure is accurately and adiabatically expanded to a minimum pressure, the steam at the point of discharge issuing as a solid jet without a tendency of its particles to divert in any direction. A characteristic feature of this type of turbine is that none of its running parts are subject to the full pressure of the steam, since the steam is fully expanded in the nozzles before it reaches the turbine wheel. As a consquence, the steam pressure that can be used is only limited by the strength of boilers. Moreover, a further and considerably increased economy can be obtained by using superheated steam, which this type of turbine is particularly well adapted for, having no rubbing parts requiring lubrication nor packing glands in contact with superheated steam.

A perspective view of the wheel and nozzles is given in Fig. 2. Fig. 1 shows a turbine direct connected to a dynamo, which arrangement is shown in sectional plan and elevation in Figs. 3 and 4. Fig. 1 shows the wheel with its steel flexible shaft, and Fig. 3 the same in its casing.

The steam after passing through the governor valve enters the steam chamber *D* (Fig. 3), whence it is distributed to the various nozzles. These, according to the size of machine, range in number from 1 to 12. They are generally fitted with shutting off valves, by which one or more nozzles can be cut out when the turbine is not loaded to its full capacity. This allows steam of boiler pressure to be almost always used, and adds to the economy on light loads.

After passing through the nozzles, the steam, as above explained, is completely expanded, and in blowing through the buckets its kinetic energy is transferred to the turbine wheel. After performing its work the steam passes into the chamber *G*, and out through the exhaust opening *H*. The wheel and case covers are so shaped as to form a safety arrangement around the hub of the wheel for the purpose of checking its speed in case of an accident to the shaft.

The velocity of the trubine wheel and shaft, in most cases too great for practical utilization, is considerably reduced by means of gearing, which is usually made 10 to 1. The gear is mounted and enclosed in the gear case *I*. *J* is the pinion made solid with the flexible shaft and engaging the gear wheel *K*. This latter is forced upon the shaft *L*, which, with couplings *M*, connects to the dynamo or is extended for a pulley. *O* is the governor held with a taper-shank in the end of shaft *L*, and by means of the bell-crank *P* operates the governor valve.

The flexible shaft is supported in three bearings. *Q* and *R* are the pinion bearings and *S* is the main shaft bearing, and carries the

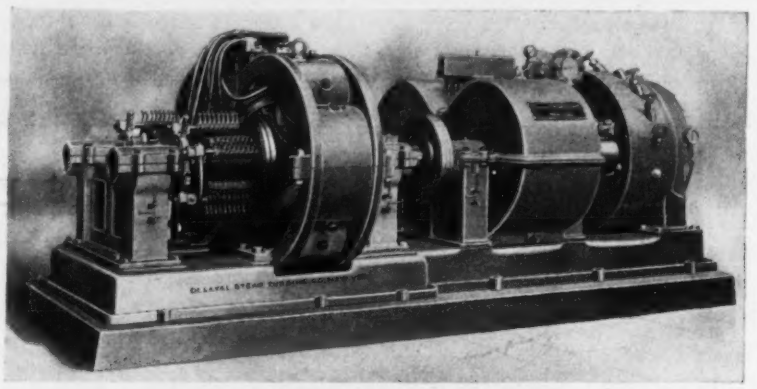


FIG. 1.—DIRECT-CONNECTED TURBINE.

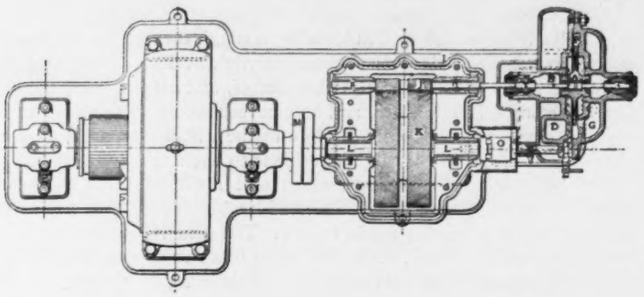
greater part of the weight of the wheel. This latter bearing is self-aligning, and is held to its seat by the spring and cap shown. *T* is the flexible bearing. This bearing is entirely free to oscillate with the shaft, and its only purpose is to prevent escape of steam when running non-condensing, or air from entering the wheel case when the turbine is running condensing. All the bearings of the flexible shaft, as well as the gear wheel, are lubricated from a central oil reservoir *U*, mounted upon the gear case; all other bearings are self-oiling. The bearings are plain and simple in construction, and made in two halves, so as to easily be taken out and examined. They are lined with anti-friction metal, are reamed true and to exact size, and have the outside surface ground to insure perfect fitting and alignment. The bearings even in the largest sizes are removed and replaced without moving or raising the shaft from its seat.

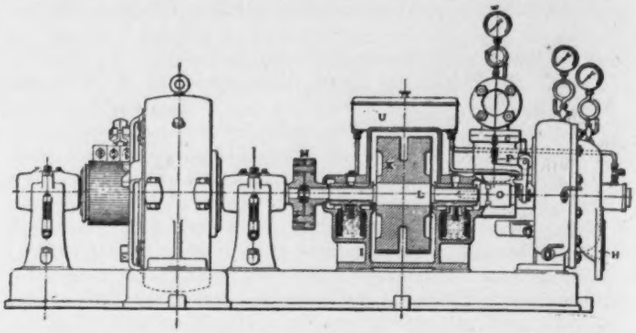
The flexible shaft is mainly supported on each side of the pinion by main bearings *Q* and *R*, which bearings are placed a considerable distance apart. The shaft is at the same time made very slender, which gives it a certain amount of flexibility and allows the turbine wheel, when the so-called critical speed is reached, to revolve around its true center of gravity. This critical speed, dependant upon the flexibility of the shaft, occurs well below the normal speed of the turbine and marks the disappearance of all vibrations.

The turbine wheel is made of forged nickel-steel, and will withstand more than double the normal speed before showing any signs of distress. In the smaller sizes the wheels have a hole through the center and are forced upon a taper sleeve shrunk on to the shaft. The larger wheels are made solid, with the shaft in two pieces screwed to the flanges of the wheel. The buckets are drop forged and made with a bulb shank fitted in slots milled in the rim of the wheel. By this

method the buckets can easily be taken out and new ones inserted, should occasion require, without damage to the wheel.

With the high speed used in the De Laval Steam Turbine a governor of small dimensions, and yet very effective, can be used. The governor is compact and simple in construction. The two weights are pivoted on a knife edge with hardened pins bearing on a spring seat. The governor body is fitted in the end of the gear wheel shaft *K*, and has seats milled for the knife edges. It is afterwards reduced in diameter to pass inside of the weights, and in its outer end is threaded for adjusting butt, by means of which the spring and eventually the speed of the turbine is adjusted. When the speed exceeds the normal, the weights, affected by the centrifugal force, spread apart and pressing on the spring seat *D*, push the governor pin forward, thereby cutting off part of the flow of steam.





FIGS. 3 AND 4.—SECTIONAL PLAN AND SECTIONAL ELEVATION OF TURBINE.

Many authoritative tests have been made in Europe on the De Laval steam turbine, and these show that it is a very efficient heat engine. In a test by Professor Cedarblom, of the Royal Polytechnic College, of Stockholm, a 50-hp wheel was operated for eight hours and the load determined by the friction brake method. The boiler pressure was 122 lbs. per square inch, and 26-inch vacuum was maintained by a Korting ejector condenser. The steam consumption was found to be at the rate of 19.73 lbs. per brake horse-power-hour. A test of a 150-hp turbine was also conducted by Professor Cedarblom. This showed a steam consumption varying from 17.35 to 22 lbs. per brake horse-power-hour, the former corresponding to a brake load of 160 horse-power, and the latter to a brake load of 38 horse-power. A 300-hp turbine gave on test a steam consumption varying from 13.96 lbs. per horse-power-hour at 307 brake horse-power, to 21.3 lbs. per horse-power-hour for 31.9 brake horse-power. In the latter test, throwing off the maximum load (307 lbs.) caused the speed to increase but 4 per cent.

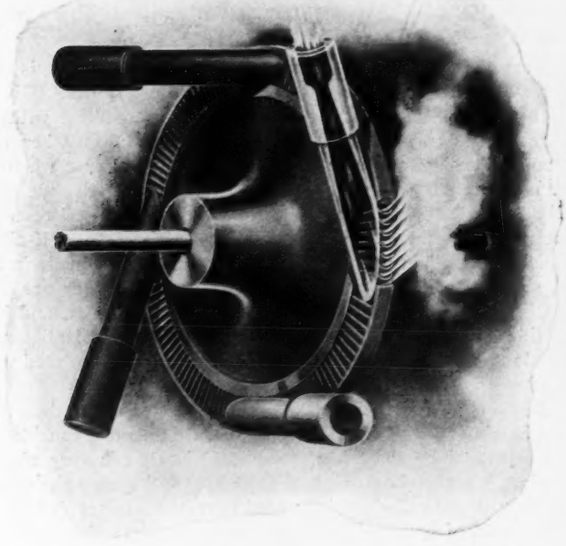
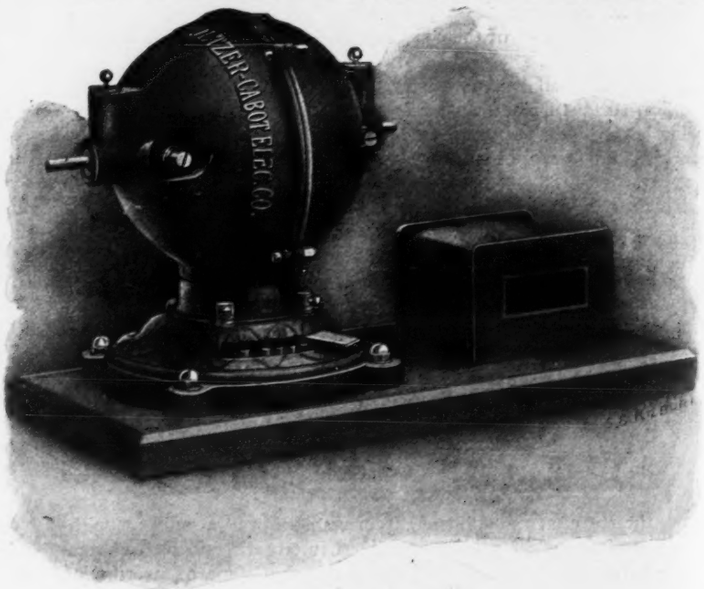


FIG. 2.—PERSPECTIVE VIEW OF STEAM TURBINE.

A Watch Demagnetizer.

The accompanying cut shows a special demagnetizing appliance, which is being manufactured by the Holtzer-Cabot Electric Company, of Boston, Mass. It relies for its principle upon the demagnetizing or reversal properties of the alternating current. The machine shown is a special form of dynamotor or rotary transformer, the primary of which may be wound for any direct current up to 250 volts. The secondary half of the armature delivers an alternating current of a convenient voltage, and a frequency that has been found thoroughly effective for the work. The current from the secondary is introduced directly into the coil shown, thus creating in the region in the center of the coil an intense magnetic field whose polarity reverses with each reversal of the current. The watch, or article to be demagnetized, is introduced into the orifice. It is, of course, instantly demagnetized and remagnetized with the opposite polarity, demagnetization and remagnetization following each other with a rapidity depending upon the frequency of alternation of the current. If the article be slowly withdrawn it is evident that each half cycle of magnetization will be of a lesser degree than the one preceding, until the piece is entirely withdrawn from the influence of the field, when the magnetism will be practically all removed. Obviously, the higher the frequency of alternation of the demagnetizing current, the more complete will be the demagnetization. The ordinary appliances, as is well known, aim to accomplish their purpose by revolving the watch rapidly before the poles of a horseshoe magnet, or reversing a battery current through a demagnetizing coil at a comparatively low frequency, by means of a hand gear. If it is attempted by these methods to approach the high rapidity of alternation which is easily obtained with the dynamotor, prohibitive mechanical difficulties are soon encountered. Furthermore, it is not possible to produce the high intensity of magnetization with the permanent magnet, which is readily obtainable with the electric current.



WATCH DEMAGNETIZER.

The National Association of Automobile Manufacturers.

The first annual convention of the National Association of Automobile Manufacturers for the discussion of trade topics will be held in the Assembly Room of the Madison Square Garden during the week of the Automobile Show on the forenoons of Tuesday and Wednesday, Nov. 5 and 6, 10 to 12 o'clock. The committee in charge of the programme and arrangements have mapped out an interesting meeting, which will be open to the public. Among the subjects to be discussed are: The National Association, protective tariff and undervaluations, legislation, transportaion, commercial gasoline, wheels, steel tubing, tires, races, good roads, prices and discounts. Men of special ability as speakers and writers on these different subjects have been selected, among whom will be: Samuel T. Davis, Jr., Messrs. Schwarzkopf, of *Automobile Topics;* Goodman, of the *Motor World;* W. W. Niles, George F. Chamberlin, Edward W. Adams, John Brisben Walker, Charles E. Duryea, E. P. Wells, Albert T. Otto, Kirk Brown, Alexander Winton, T. C. Martin, of Electrical World and Engineer; W. P. Stevens, of the *Motor Review,* and representatives of the Goodrich, Diamond, Hartford, Standard Oil and Shelby Tube companies.

The annual meeting of the association for the election of executive committeemen will be held in the same place at 8.30 p. m. on Thursday, Nov. 7, upon the termination of which there will be a dinner, with post-prandial oratory. It is hoped to be able to secure as one of the bright particular stars for this event ex-President Eddy, of the Chicago Automobile Club, who made such a witty and brilliant speech at the Garden dinner last year. Mr. E. D. Knappen is the active assistant secretary of the organization.

Snap Cover Steel Conduit Moulding and Safety Switch.

The accompanying illustrations refer to a new type of safety switch and a new type of steel conduit and moulding that are being brought out by E. E. Clock, of Passaic, N. J. The switch is designed to overcome the annoyance and sometimes danger in fusing a main line cut-out on a live line. As will be noted, the fuse is attached to a switch having a fiber blade. When a fuse blows it is withdrawn from the circuit upon pulling the switch, and after re-fusing the switch is closed.

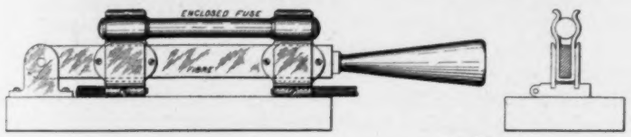


FIG. 1.—SAFETY SWITCH.

The conduit illustrated unites, as will be seen, the convenience of a capped moulding with the security of a metallic tube. It consists of a portion easily attachable in installation, and a cover for making the conduit entirely enclosed, which cover is snapped in place. The illustration shows two forms in which the conduit is made, one being cylindrical and the other having more the shape of an ordinary wood moulding.

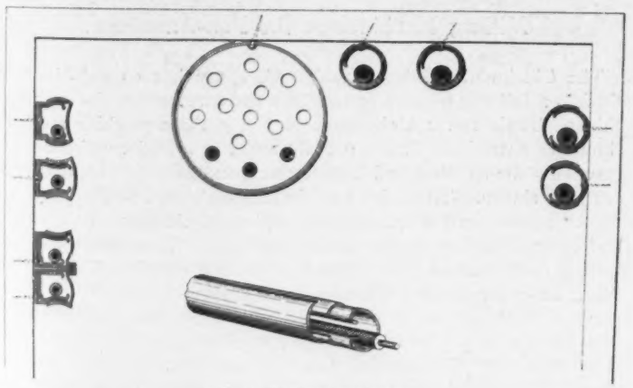


FIG. 2.—STEEL CONDUIT.

Automatic Door Switch.

The automatic door switch, illustrated herewith in Figs. 1, 2, 3 and 4, is enclosed in a steel case with semi-circular ends. This form of case facilitates letting the switch into the door jamb, as, after three 1-inch holes are bored, it is only necessary to cut out the wood between them to admit the case, and it is not necessary to square up the ends of the oblong opening.

FIG. 1.—STRIKE.

FIG. 2.—DOOR SWITCH COMPLETE.

The insulation of the current-carrying parts from the mechanism, as in all switches of this type by the same maker, the Hart Manufacturing Company, of Hartford, Conn., is effected by the use of sheet mica. The spring bronze contacts are carried by a porcelain block, which is screwed to the bottom of the case, and extends through the bottom at the end where the wires enter. The binding screws on the face of this block are accessible from the front.

The parts of the switch most subjected to wear are made of nickeled steel. The springs are of the best music wire, nickeled, are helical in form and of large diameter.

The action of the switch is smooth and easy. The break is 1¼ inches in length, and is sufficient for 3 amperes at 250 volts. A steel template is furnished, which, when placed against the door jamb and tapped with a hammer, gives the location of the centers of the two screw holes at the ends of the face plate, and also of the three 1-inch holes to be bored for the case. It also gives the outline of the face-plate.

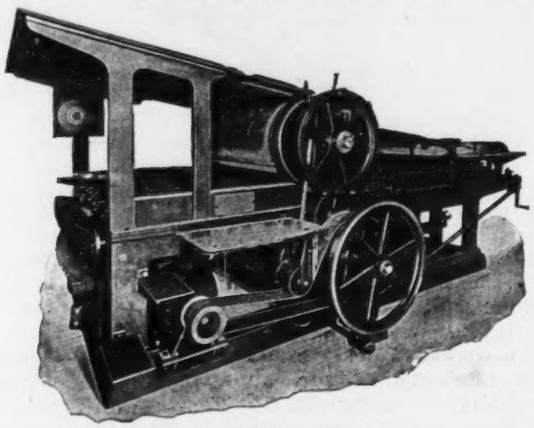
FIG. 3.—SWITCH "ON."

FIG. 4.—SWITCH "OFF."

These switches have been given tests equivalent to years of actual service, and it is stated that not one has given out or shown weakness.

A Modern Printing Press Equipment.

Electrically driven printing presses have been in operation long enough to demonstrate beyond question their superiority over all other kinds. The individual equipment of each press is also conceded to be the most satisfactory, but it is sometimes a question which method—belted, geared or direct connected—gives the best results. One of the most successful is a belted equipment recently perfected by the Sprague Electric Company, and shown in the accompanying illustration. It consists of a Lundell 4-hp, standard speed, compound-wound motor, belted to a flat-bed press. The motor is controlled by one of the Sprague Company's standard rheostatic rotary controllers, used in connection with armature and shunt field regulating resistances. The pulley on the motor is 4½-inch diameter and 6-inch face, and the pulley on the main driving shaft of the press is 22-inch diameter, 6-inch face. The transmission of the power from the motor to the press is obtained with a medium thickness perforated endless belt 5½-inch wide, which insures noiseless operation and reduces slippage to a minimum. An idler or belt tightener is used, which, together with the motor brackets, are furnished and attached by the press manufacturer. This method of equipment has merit, owing to the possibility of sudden strains being put on the gears of the press or the motor by the rapid manipulation of the controller.



ELECTRICALLY DRIVEN PRESS.

With this equipment, if the controller suddenly throws the full power upon the motor, it causes a slight slippage of the belt until the press has attained its speed.

The motor is attached to a removable bed plate, which permits the motor, in case of accident, to be withdrawn and another substituted while repairs are being made. This equipment has the additional advantage of being an economical installation.

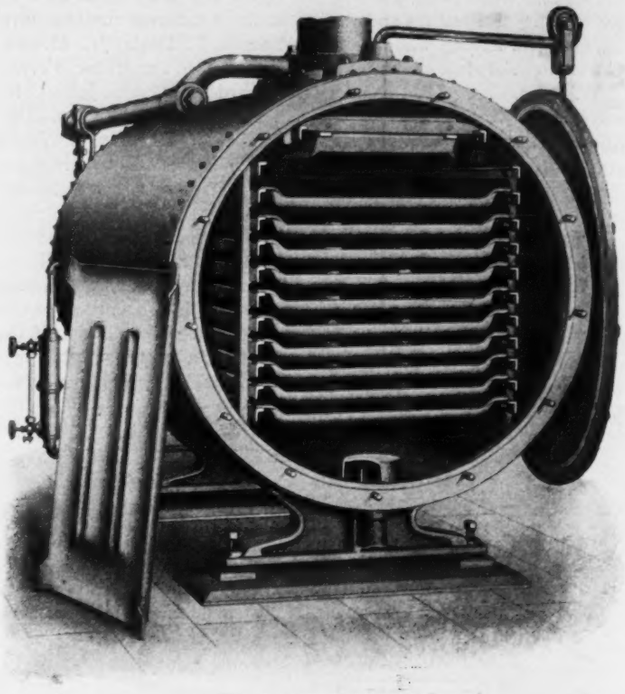
New Feed Water Heater.

We illustrate a new form of feed water heater recently brought out by the Hoppes Manufacturing Company, of Springfield, Ohio, intended to be used where the water contains acids or other corrosives, but not to take the place of the company's regular form of heaters with steel pans, where the water is neutral or contains large quantities of lime and other solids. The illustration clearly shows this heater, and it is only necessary to say that the pans and all parts with which the feed water comes in contact are made from cast iron and where bolts are used they are bronze. In designing this heater, use was made of the well-known Hoppes system of flowing water along the underside of the pan in thin films in such a manner that the exhaust passing through the heater would come into direct contact with the water.

The pans in this heater are cast in one piece and are in form a multiple of trough shape sections, joined at each end by a section of the same form and provided at each corner with lugs for supporting the pan on the ways in the heater. The pan shown beside the heater in the cut will give a good idea of the shape used in this construction. It will be noticed that the water will flow over the edges of the pans and also through the slots. The water flowing over the sides of the pans or edges will follow the underside of the pan to the lowest point before dropping into the next pan below, and so on over each pan until it reaches the reservoir at bottom. The exhaust steam passing through the heater comes into direct contact with the water flowing over the pans and therefore can impart its heat to the water without heating through the metal of the pans or lime deposited thereon.

The comparatively flat form of this pan permits of about twice the amount of surface being put into a heater of a given size as compared with the original form, and as a smaller shell can be used much saving of space is effected. This heater is provided with a hooded outlet for the pump suction which acts as a skimmer, and when desired a filter is also provided.

A large and efficient oil catcher is located in the back of the heater and a float and balanced valve is provided for regulating the feed water inlet. It will be noticed that the entire head of the heater is



FEED WATER HEATER.

removable so that access may be easy to all parts of the heater for cleaning or examination; and a crane is provided for removing this head as shown in the engraving. A trap is also provided for the oil drips from overflow when the heater is used in connection with a heating system.

Heaters of this construction have been manufactured by the Hoppes Company for a little less than one year, but it has now in use machines ranging in size from 150 horse-power to 7000 horse-power, all of which are giving excellent results. The large reservoir at the bottom of this heater makes it well adapted to be used as a heater and receiver where installed with a heater system.

Milling Machines at the Pan-American.

The Cincinnati Milling Machine Company has on exhibition at Buffalo a full line of milling machines and attachments for such machines. Their No. 2 Universal and No. 3 Plain machine are both shown in operation. A No. 0 Plain and No. 4 Plain, which are respectively the smallest and largest machines made by this company, are also shown. The chief new feature embodied is the positively driven geared feed mechanism, supplying 16 changes on the larger and 12 feed changes on the smaller machines. This mechanism is a bold departure from past practice in milling machine design, there being an entire absence of chains and friction devices. The entire train of feed gearing is carefully designed and the machines have been in use long enough to prove it amply strong for the heaviest duty that can be imposed on it by the main driving belt of the machine. The attachments shown cover the entire range of milling operations. Notable among these are a special spiral milling head for heavy work, and a vertical spindle milling head, which, when attached to either the No. 3 or No. 4 machines, converts them into vertical millers. There is also a universal cutter and reamer grinder in constant operation, as part of this company's exhibit, which, as already noted, won the highest award possible.

The Kellogg Telephone and Switchboard Exhibit at the Pan-American Exposition.

One of the most attractive and conveniently arranged booths in the Electricity Building is that of the Kellogg Switchboard & Supply Company. The display made by this company is very elaborate, and the illustrations of which are shown in this issue, will clearly emphasize this statement. In order to exhibit to best advantage the systems and apparatus manufactured by this company, it was found necessary to provide two booths. The main booth, Section R, contains a general display of its different apparatus, while its branch

FIG. I.—VIEW OF MAIN EXHIBIT.

booth, Section F, is used to display and demonstrate the practical working of subscriber's telephone apparatus.

One of the first things to attract attention upon entering the main booth is a single section of what is stated to be the largest centralized energy multiple switchboard ever built. The ultimate capacity of the complete switchboard is 12,000 subscribers' lines. A board of this type fully equipped would require about 40 of these sections. It is provided with line lamp signals and double-lamp supervisory signals in the cord circuits. One of the unique features of this board is the simplicity of the spring jacks, which are provided with only two terminals, and are mounted 40 per strip on 3/8-inch centers, thus greatly reducing the area occupied by the multiple jacks on the face of the section, and making the cabling so simple as to be easily wired and maintained. The cabinet is of a rich, solid mahogany, and is provided with a plate glass panel in the end, which enables one to observe the complete arrangement of the multiple cabling. The back of the cabinet is provided with a roller curtain constructed so as to make the board practically dust proof.

At the front of the open space is a plate glass display show case, which contains an interesting exhibit of small telephone apparatus used in the construction of switchboards and subscribers' outfits. Several important pieces of this apparatus are shown unassembled. A duplicate of this show case in the rear of the 12,000 line board contains a complete line of samples of fine magnet wire, switchboard and telephone cords, and switchboard cable, all of which form a part of this company's product.

Supported on elaborate show boards conveniently arranged in this space is shown a complete line of subscribers' wall sets comprising over 36 different types and finishes. These instruments are all connected to switchboards for demonstrating purposes. A sound-proof booth, located in the rear of the space contains magneto and centralized battery subscribers' sets for testing the quality and strength of transmission and comparison of systems.

The section of a 3000-line centralized battery switchboard shown is called by this company a "minor" board to distinguish it from their "major" board, an example of which is the 12,000 line switchboard described above. This board has several distinctive features besides being provided with full lamp signals. It has all of its operating apparatus conveniently located in the cabinet. This is made possible by the compact construction of the relays. Strips of ten relays are made in a cast-iron case, so as to be mounted on the structural steel frame in the rear of the switchboard. Only one relay is necessary for each line, and there are no contacts to open or close in the talking circuit from the subscriber's instrument to the line jack. Several instruments are connected to this switchboard for demonstrating purposes.

Another switchboard shown in this space which is particularly interesting is a two-division centralized battery lamp signal switchboard. With this type of board, the subscriber is provided with two push buttons which enable him to make direct connection with either division of a two-division multiple switchboard, thus making it possible to connect directly with the subscriber desired, without the use of trunk lines.

A combination centralized battery and magneto switchboard is also exhibited in this main floor space. This switchboard is intended for use in small towns where it is desired to give the town subscribers the advantage of the latest designs of telephone apparatus and to make it possible to directly connect magneto lines, such as toll lines and long farmers' lines, with the centralized battery town subscribers. This board has a capacity of 160 centralized battery lines and 30 magneto lines.

A wall-type switchboard which is also shown, has a capacity of 20 magneto lines, provided with apparatus for four-party line selective signaling. This particular type of switchboard is largely used for connecting farmers and toll lines, and its construction is nearly as simple as the regular subscribers' wall set, so that it requires no experience to operate it.

Besides the instruments and apparatus described above, the main exhibition space contains four "express" switchboards ranging from 50 to 200 lines capacity. These switchboards are provided with mechanically self-restoring drops, and a very substantial and convenient arrangement of cord equipment. This type of board represents the simplest forms of telephone exchange equipment for use in small towns where an efficient and rapid means of inter-communication is desired.

At the rear of this main exhibition room just described is an "exchange room," in which is located a centralized battery "major" switchboard of 3000 ultimate capacity with a present equipment of 980 lines. All the apparatus necessary to make this a complete working exchange is located either in this room or in the basement under

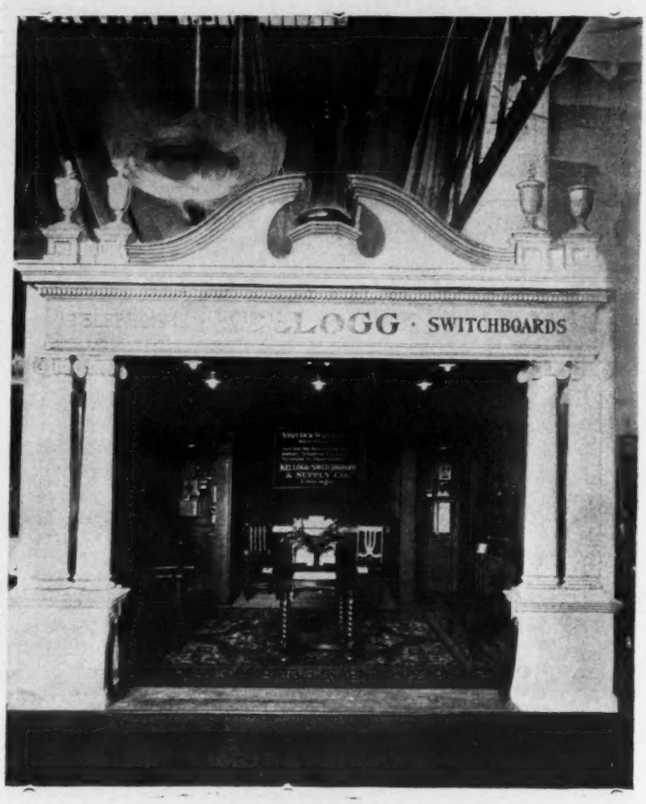


FIG. 2.—BRANCH BOOTH.

the booth. A large number of subscribers' instruments of different designs, located in Sections F and R, are connected to this board to show its operation.

The arrangement of the switchboard in the "exchange room" is the same as that of an operating exchange. There are three sections of three operators' positions each, the two end positions being left

blank. This gives each operator 140 lines, each of which terminate in an answering jack with its associated line lamp signal. The answering jacks and lamps are arranged 20 per strip, and are located just bove the key shelf in the face of the board. Above the answering jacks and lamps, but separated by white holly strips, are the multiple jack arranged 20 per strip, and above these are the spaces for the multiple jacks required by future growth. These latter spaces are fitted with black ebonized panels. The multiple jacks are divided by white holly strips in banks of five strips, thus making 100 jacks for each bank. Each section of the board is divided by vertical style strips into six panels, thus giving two panels for each operator's position. The key shelf contains a complete equipment of 15-cord circuits for each operator. These cord circuits are provided with ringing and listening keys and double-lamp supervisory signals, there being one lamp signal for each half of the cord circuit.

A rear view of this switchboard brings out a most striking feature in connection with this "model exchange," that is, its simplicity and the small amount of cabling used in its construction. This is due to the fact that it is operated on what is known as the two-wire multiple system. The circuits of this board have been so perfected that none of the answering or multiple jacks require more than two contacts. Thus the cabling and general construction of all the apparatus is very much simplified over other systems. The frame of this board, as in the 12,000 line "Major" switchboard, mentioned above, is constructed of structural steel. The cabient is of solid mahogany, and the opening of the back of the board is closed by roller curtains.

The storage batteries for supplying all direct current for the exchange are installed in a room located in the rear of the basement. This room is provided with ample ventilation and a concrete floor sloping to a drain. Each battery consists of 10 chloride cells, 240 ampere-hour capacity, this being sufficient for the present equipment of the exchange. The elements are contained in tanks of 480 ampere-hour capacity, which are large enough for the ultimate capacity of the exchange. The "discharge leads" from the battery lead directly to

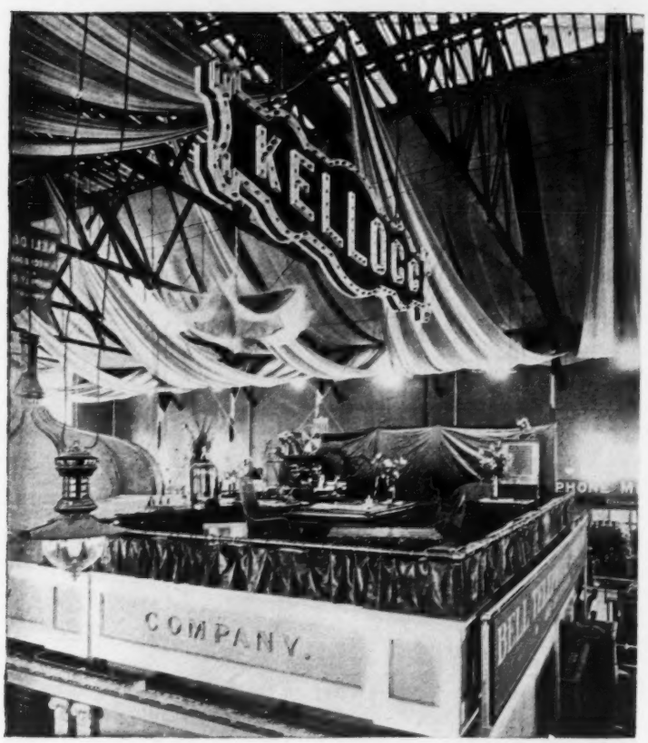


FIG. 3.—ROOF GARDEN, TOP OF MAIN EXHIBIT.

the fuse board located just outside the battery room. From the fuse board wires are lead to the individual cord circuits at each section of the main switchboard.

The power switchboard used for handling all heavy currents required in the exchange, such as the currents for the charging and ringing machines, and the charging and discharging circuits of the storage batteries, is located next to the wall of the storage battery room. It consists of two slate panels mounted on an iron framework. On the first panel are mounted all the switches, starting boxes and other apparatus necessary for controlling the current delivered to the motor side of the machine. The second panel contains all of the switches, underload and overload circuit breakers, ammeter, shunts and rheostats for controlling the generator current in charging the storage batteries. At the top of these slabs are mounted a flush round pattern Weston ammeter, and a voltmeter and switches for connecting them to any of the direct-current circuits terminating in the power switchboard.

A duplicate set of charging and ringing machines are used in connection with this exchange as an extra precaution against breakdown or the failure of current supplied from an outside source. The

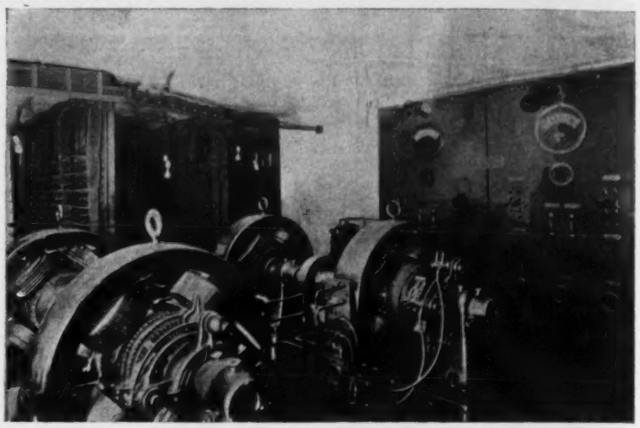


FIG. 4.—POWER EQUIPMENT.

machines are of the Holtzer-Cabot type and of the following sizes: The two generators provided for charging the storage batteries from 110 volts direct current are Holtzer-Cabot type M. P. D., 1850 watts output. There are two ringing machines, Holtzer-Cabot type B, ¼ horse-power. One runs from 110 volts direct and the other from 10 cells of storage battery. These ringing machines deliver 75 volts alternating and pulsating current from their secondary windings.

The power apparatus is mounted on power tables constructed of masonry, the sides are covered with white tile brick, the whole being capped by a heavy slate top. All slate used in both power boards and tables was obtained from the famous Monson Maine quarries, and is especially adapted for this purpose. All the power wiring in this "model exchange" is of the most substantial character, and is protected by being drawn into "Richmondt" steel conduit.

The roof garden, located over the "Exchange Room," of the main exhibit, is reached by a flight of winding stairs similar to those commonly used in telephone exchanges. Suspended over this roof garden from the girders of electrical building, is an elaborate double-faced electric sign nearly 22 ft. long, and about 7 ft. high, built by the A. & W. Electric Sign Company, Cleveland, Ohio. Each letter of this sign is connected to a "flasher" located in the basement of the booth, so that the word "Kellogg" can be flashed in any combination.

In order to demonstrate the operation of the Kellogg systems, and especially the transmission and receiving qualities of their subscribers' instruments, it was found necessary to isolate a part of their exhibit so as to give more nearly the actual condition of the subscriber with relation to the exchange. Thus the branch booth in Section F was designed solely for this purpose. This space is provided with two sound-proof telephone booths, same as used for long-distance transmission work. These booths are both supplied with centralized battery and magneto subscribers' instruments, which are connected by artificial lines to the switchboards located in the main exhibit, Section R.

The architectural design and arrangements of these booths are well balanced, and with the extensive exhibit they go to make up one of the largest and most interesting collections of telephone apparatus ever shown to the public.

The Kellogg Switchboard & Supply Company's industry is claimed to be one of the largest in Chicago. The factory has a capacity of 2000 telephones a week. It has 89,000 square feet of floor space, and employs nearly 1000 men. The company has one of the largest and the most perfectly equipped telephone laboratories for expert study, testing and experimenting in the world. The engineers employed are leading men in their profession, and all of them have had a broad and varied experience in electricity and telephony. As noted last week, the company has been awarded gold medals for its apparatus shown at the Pan-American.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Call money closed at 3 per cent nominal; time money, which was easy throughout the week, closed at 4¼@4½ per cent for high-grade loans; 4¾@5 on mixed collateral. The stock market lacked public support and transactions were narrow, industrials, including United States Steel stocks, being neglected. Some pressure was noted in the traction stocks, Metropolitan selling off on reports of a possible dividend reduction, which were, however, denied. Notwithstanding the adverse influences this stock closed at 158⅛, which is a net gain of 1⅝ points on the week's transactions, and only ⅞ below the highest quotation for the week. The sales aggregated 21,350 shares. Brooklyn Rapid Transit closed at 60⅞, a net gain of ¾ of a point. General Electric fluctuated between 255 and 259, closing at 257, a net gain of 2 points, the total sales being 2400 shares. Western Union Telegraph gained ⅛ point, quotations keeping within a narrow margin.

NEW YORK.

	Oct. 15.	Oct. 22.		Oct. 15.	Oct. 22.
American Tel. & Cable..	—	—	General Carriage.....	⅞	¾
American Dist. Tel.....	—	—	Hudson River Tel.....	112	112
Brooklyn Rapid Transit.	59¾	61½	Illinois Elec. Veh. Trans.	—	½
Commercial Cable.....	—	—	Metropolitan Street Ry..	158	157¾
Electric Boat.....	22	18	N. E. Elec. Veh. Tran...	—	—
Electric Boat pfd.....	45	45	N. Y. Elec. Veh. Tran...	7	6¾
Electric Lead Reduc'n...	2	2½	N. Y. & N. J. Tel.....	166	166
Electric Vehicle.....	1¼	1¾	Tel. & Tel. Co. of Am...	5	—
Electric Vehicle pfd.....	3	3½	Western Union Tel.....	91½	91½
General Electric.....	258½	258			

BOSTON.

	Oct. 15.	Oct. 22.		Oct. 15.	Oct. 22.
Am. Tel. & Tel.....	157	158¾	Mexican Telephone.....	2⅛	2
Cumberland Telephone...	—	—	New England Telephone.	—	—
Boston Electric Light....	—	—	Westinghouse Elec.....	71½	—
Erie Telephone.....	38	36	Westinghouse Elec. pfd..	—	78*
General Electric pfd.....	—	—			

PHILADELPHIA.

	Oct. 15.	Oct. 22.		Oct. 15.	Oct. 22.
American Railways.....	40½	40	Phila. Traction.....	95⅜	95¾
Electric Storage Battery..	64	60	Philadelphia Electric.....	5⅛	5⅛
Elec. Storage Batt'y pfd..	64	60	Pa. Electric Vehicle.....	½	½
Elec. Co. of America....	6⅞	6⅜	Pa. Elec. Veh. pfd.....	½	½

CHICAGO.

	Oct. 15.	Oct. 22.		Oct. 15.	Oct. 22.
Central Union Telephone.	—	—	National Carbon pfd....	83	84
Chicago Edison.....	160	165	Northwest Elev. com.....	40	39
Chicago City Ry.....	201	201	Union Traction.....	17⅜	17
Chicago Telep. Co.....	225	250*	Union Traction pfd.....	58	58½
National Carbon.....	18	19⅛			

*Asked.

DIVIDENDS.—Directors of the Allis-Chalmers Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock. The directors of Henry R. Worthington, Incorporated, have declared the regular semi-annual dividend of 3½ per cent on the preferred stock, payable Nov. 1. The directors of the Columbus Railway have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable Nov. 1. The Grand Rapids Railway Company directors have declared the regular quarterly dividend of 1¼ per cent upon the preferred stock, payable Nov. 1. The Coney Island & Brooklyn Railway directors have declared a quarterly dividend of 4 per cent. The Albany (N. Y.) United Traction Company has declared the regular quarterly dividend of 1¼ per cent, payable Nov. 1. The Cleveland City Railway Company has declared a quarterly dividend of 1¼ per cent. The Pittsburg Traction Company has declared a dividend of 3½ per cent, payable Oct. 29. The Duquesne Traction Company, Pittsburg, has declared a dividend of 2 per cent, payable Oct. 29. The Central Traction Company, of Pittsburg, has declared a dividend of 1½ per cent, payable Oct. 29. The Consolidated Traction Company, of Pittsburg, has declared a dividend of 3 per cent upon the preferred stock for the first half of the earnings of the past six months, payable Oct. 25. The Milwaukee Electric Railway & Light Company has declared a regular quarterly dividend of 1½ per cent on its preferred stock, payable Nov. 1.

TELEGRAPH, TELEPHONE & CABLE COMPANY.—It is stated by an official of the Telegraph, Telephone & Cable Company of America that the company will enter into active competition against the Bell Company throughout the East, and the work of building lines from New York to Albany and Boston will begin at once. It is stated that wires are being run in all sections of New York City and conduits built. The new board of directors which was elected on Oct. 15 is as follows: C. W. Morse, James M. Thomas, J. A. McDonald, R. R. Moore, R. L. Edwards, J. T. Sproull, John D. Crimmins, Daniel O'Day, James T. Morse, Oakes Ames, Samuel Thomas, E. R. Chapman and Francis M. Jenks. All of the old officers of the company were re-elected. President Thomas states that all of the independent companies throughout Massachusetts will be merged and connections made from point to point. The Boston line will be run throughout New York State and a system of connecting all the cities, towns and villages has been perfected. The Albany line will tap the Boston line. After establishing the system in New York and Massachusetts, attention will be directed to other Eastern States.

THE STATUS OF INDUSTRIALS.—The *Wall Street Journal* had an interesting editorial comment last week on the weakness of industrial stocks, or, rather, their wide fluctuations as compared with "rails." It is encouraging to note that its bright stars in the industrial firmament are electrical chiefly, and it might have added Westinghouse and Bell telephone: "We do not wish to be understood as saying that all industrials are alike and that all have receivers awaiting them. Nothing of the kind. There is no taint in the word industrial. Some of the best stocks are industrials. Look at Western Union, with its long dividend record; at Commercial Cable, with its high credit; at Pullman, with the yield of a bond; at Standard Oil, with its wonderful record; at General Electric, and the way it has come out of its difficulties; at the long list of gas stocks and water stocks and private manufacturing stocks, securities which have afforded security, indeed, to those who have trusted in them."

GENERAL ELECTRIC SURPLUS.—The surplus of the company at the present time is said to amount of $14,000,000, a gain of over $7,000,000 since Jan. 1. To make full restitution to stockholders for the stock taken from them at the time the company's capital was impaired, it will be necessary that the company have a surplus of $18,000,000. It is the belief of General Electric directors that the company will be able to accumulate such a surplus by April 1. Some of the directors are desirious of restoring part of the capital stock this fall or early winter and the remainder next year, but it is said the Morgan interests think it better policy to wait until the company's surplus will permit of a complete capital restoration, and this opinion may prevail. The earnings of the General Electric Company continue large. September net earnings were between $800,000 and $900,000.

ERIE TELEPHONE.—It is said to be the idea of leading interests in the company to do away with the Erie Telephone Company as a parent company and organize a new company to take over the business of the sub-companies and operate the properties. Such a company could be formed and succeed to the business of the Erie sub-companies through the retirement of the Erie Company's bonds and the releasing thereby of the stock of the sub-companies held as collateral. It would require $14,000,000 to meet the notes of the Erie Company and retire sufficient bonds to get control of the sub-companies.

TORONTO STREET RAILWAY.—The directors of the Toronto Street Railway will increase the stock of the company $1,000,000 for the purpose of purchasing the Metropolitan & Toronto Suburban Electric Railways, 30 miles in length, extending from Toronto to Newmarket, and which will connect with the Schomberg & Aurora Electric Railway, now building. The Toronto Suburban Street Railway is 12 miles long, and connects with the Toronto Street Railway by transfer at Toronto Junction.

CENTRAL UNION TELEPHONE.—Suit has been filed in the Circuit Court against the Central Union Telephone by ten shareholders owning $129,000 worth of the company's stock. It is alleged that the action reducing and then increasing the capital occasioned a loss to complainants of half their capital. The bill says assets exceed fifteen millions; indebtedness, seven. By unanimous vote last week the stockholders of the Central Union Telephone Company, of Chicago, increased the capital stock from $3,481,500 to $10,000,000.

KEYSTONE TELEPHONE.—The Keystone Telephone Company, of Philadelphia, is offering $5,000,000 cumulative 6 per cent preferred stock, par $50 full paid, with bonus of 25 per cent in common stock. No allotment to one person of more than 50 nor less than 4 shares will be made. The company is putting into operation a large system with which to fight the Bell system in Philadelphia.

CUMBERLAND TELEPHONE.—The statement is made that Mr. Charles W. Morse, who has acquired control of the Telephone, Telegraph & Cable Company of America, has purchased the Cumberland Valley Telephone Company, of Pennsylvania, which was recently organized with a capital of $10,000,000.

NORTH AMERICAN.—The plan of the North American Company to absorb the Omaha Traction Company and many other local plants, involving a capital of $6,000,000, has been declared off.

MASSACHUSETTS TROLLEYS.—Negotiations are understood to be on for the consolidation of the Commonwealth Avenue, Newton & Boston, Lexington & Boston, and several other suburban lines operating west of Boston and within a radius of 20 miles. Considerable progress has been made in the direction of a union, and the proposition under consideration is said to contemplate the organization of one large company which shall control the entire system with a capital sufficiently large to admit of certain important extensions, and a material improvement in the existing service.

B. R. T. STOCK.—The Brooklyn Rapid Transit Company has applied to the New York Stock Exchange to have its $45,000,000 stock regularly listed. The stock has heretofore been traded in in the unlisted department.

Commercial Intelligence.

THE WEEK IN TRADE.—Dispatches to the mercantile agencies brought reports of stimulated retail trade, due to cooler, settled weather and advices of continued activity in all leading industrial lines, notably iron and steel. Consumption in the latter continues equal to, and in some cases, exceeds, the production. Orders for fully 1,000,000 tons of rails for next year's delivery have been booked at higher rates, and railroads are in the market for cars, one Western system having bought 2000 during the week. Despite predictions of a heavy cut in copper prices, the fact remains that lake copper supplies are small, and prices were actually higher last week at New York than those of the week previous, although they were lower in London. The market was quiet but steady ,and there was more confidence shown. The quotations are 16½@16¾c. for Lake; 16¼c. for electrolytic in cakes, wire bars and ingots; 16c. for cathodes and 15⅞c. for casting stock. The business failures for the week, as reported by *Bradstreet's*, aggregated 198, as against 183 the week previous, and 233 the same week last year.

THE BANKRUPTCY LAW.—A special committee on revision of the Bankruptcy Act, has just been appointed by Mr. De Le Roy Dresser, president of the Merchants' Association of New York, pursuant to a request made by a number of its prominent members at a conference recently held with United States Assistant Attorney-General E. C. Brandenburg in reference to this matter. The purpose of this committee is to make a study of the present act, to point out its defects, and to suggest amendments to remedy the same. The committee will report to the Board of Directors of the Merchants' Association of New York. It is expected that this work will be completed in time to be effective during the next session of Congress, at which time amendments to the present act will be sought. The committee in full is as follows: George F. Vietor, of Frederick Vietor & Achelis, chairman; Ora Howard, of Oelbermann, Dommerich & Co.; W. T. Evans, of Mills & Gibb; M. E. Baunin, of Converse, Stanton & Co.; Ewald Fleitmann, of Fleitmann & Co.; B. F. Shores, of Austin, Nichols & Co.; E. D. Page, of Faulkner, Page & Co.; C. N. Bliss, Jr., of Bliss, Fabyan & Co.; Charles E. Meek, of the National Lead Company; A. H. Watson, of Passavant & Co.; Carl Schefer, of Schefer, Schramm & Vogel; C. H. Webb, of J. H. Dunham & Co.; W. S. Mersereau, of Schieffelin & Co.; R. B. Hirsch, of William Openhym & Sons; William F. King, of Calhoun, Robbins & Co.; Benno Neuberger, of E. Rosenwald & Co.; John C. Eames, of the H. B. Claflin Company; George H. McNeir, of W. & J. Sloane; Chester A. Braman, of A. D. Juilliard & Co.; E. W. Riker, of Yale & Towne Manufacturing Company.

EXPORTS OF ELECTRICAL MATERIAL AND MACHINERY.—The following are the exports of electrical material, machinery, etc., from the port of New York for the week ended Oct. 16: Antwerp—23 packages, $1,181; 2 packages electrical machinery, $582. Argentine Republic—107 packages, $4,757; 2 bundles of copper wire, $62. Bilbao—1 package electrical machinery, $7. British Australia—1563 packages electrical machinery, $240,684; 131 packages, $3,852. Berlin—6 packages, $2,233. Bremen—9 packages, $330. British Guiana—9 packages, $225. British East Indies—1 package electrical machinery, $30. Brazil—21 packages, $942. British Possessions in Africa—33 packages, $3,055; 64 packages electrical machinery, $2,883. British West Indies—25 cases, $359. Copenhagen—1 case, $80. Cuba—79 packages, $1,278. Dutch West Indies—15 cases, $300. Glasgow—21 cases, $210; 6 cases electrical machinery, $1,082. Genoa—4 cases, $580. Havre—20 packages, $3,438. Hayti—18 packages, $201. Haarlem—1 case electrical machinery, $21. Hamburg—56 packages, $2,500; 77 cases, $3,113; 11 packages, $1,440. Japan—1 case, $40. London—257 cases electrical machinery, $6,445; 106 cases, $4,127. Liverpool—75 packages, $16,692; 147 packages, $6,099. Milan—2 cases, $500. Manchester—14 cases, $1,794. Mexico—133 cases electrical machinery, $9,846. Newcastle—20 packages electrical machinery, $7,805. Peru—10 packages, $550; 4 packages, $288. Rotterdam—4 packages, $55. Southampton—14 packages, $441. Santo Domingo—1 case electrical machinery, $14; 16 packages, $1,004. Tasmania—4 packages electrical machinery, $1,299. U. S. Colombia—24 packages, $1,026. Venezuela—47 packages, $1,480.

VARIOUS ORDERS FOR RONEY STOKERS.—Westinghouse, Church, Kerr & Co., of New York City, report a number of substantial orders received within the last ten days or so calling for the installation of Roney mechanical stoker equipments in various steam plants throughout the country. One of the principal contracts recently received was from the Rhode Island Suburban Company, of Providence, R. I., for an 8000-hp plant. The New York Glucose Company's plant at Shadyside is being fitted with a 4000-hp stoker equipment. The new plant in connection with the shops of the department of steam engineering of the Brooklyn Navy Yard is to have a 1500-hp equipment. The boiler contract for this plant has been allotted to the Babcock & Wilcox Company. The New Perth Amboy, N. J., works of the De Lamar Copper Company is to be equipped with Roney stokers for a 1000-hp plant, and the American Bridge Company, of New York, has called for a similar equipment to be installed in its Post & McCord plant, in Brooklyn. Smaller contracts lately obtained include one for a 500-hp outfit for Pingree & Smith, Detroit, Mich.

THE ARGENTINE REPUBLIC.—Mr. Simon W. Hanauer, deputy United States Consul-General at Frankfort, Germany, writes us: "The electrical industry is making rapid progress in Argentina, especially in Buenos Ayres. Several factories are already existing there which turn out small dynamo machines, etc. The importation of electrical supplies during 1900 amounted to more than $1,000,000, composed of dynamo machines valued at $80,025; cables, etc., $511,709; lamps, $101,112; telephone materials, $20,143; telegraphic materials, $36,993, and other supplies for electrical purposes worth $341,034. These supplies were mainly furnished by Germany, Belgium, England, France and the United States. A small part came from Italy and Holland. It were well if the Monroe Doctrine in a commercial way, devoid of coercive or warlike spirit, could be extended over our sister republics on our continent. In the natural course we, the progressive manufacturing and agricultural nation in the world, should supply all their wants in foreign products."

DEMAND FOR ELECTRIC PLANT IN GREECE.—Consul McGinley reports from Athens, Sept. 12, 1901, that the Mayor of Karpenesion, a village in the province of Evrytania, wishes to have that place lighted by electricity, and has requested the Consulate to publish the fact in the United States, hoping to induce some American company to sell him a suitable plant. There is a stream near the village that can be utilized to furnish the necessary power for the plant. There are 400 houses in the village, and the Mayor estimates that about that number of incandescent lights will be required. He does not mention the number of arc lights required. Karpenesion is the village which the heroic Greek chieftain, Marco Bozzaris, was defending when, in 1823, he fell in a midnight sortie against the Turks, an event made famous by Fitz Greene Halleck's stirring poem. This is but one of several electrical opportunities recently suggested from Greece.

MORE AMERICAN CABLE FOR GLASGOW TRAMWAYS.—The National Conduit & Cable Company, whose New York offices are in the Times Building, Park Row, is to furnish nearly $250,000 worth of cable for an extension of the Glasgow Corporation Tramways. The cable will be manufactured at the company's plant at Hastings-on-Hudson. It will be recalled that the National Conduit people were awarded the contract—valued at over $1,000,000—for the supplying and laying of the conduits in connection with the original electric traction system of the Scotch city, fully 90 per cent of the entire equipment for which was purchased in the United States.

WESTINGHOUSE ENGLISH FACTORY.—A contract has been closed by the London office of the Buffalo Forge Company with the British Westinghouse Electric & Manufacturing Company, Trafford Park, Manchester, for apparatus to be used for heating and ventilating the machine shop, foundry stores, the carpenters' shop and box factory of the new works. The machine shop is 900 ft. long, 420 ft. wide and 59 ft. high. To heat and ventilate this area eight steel plate fans, each capable of delivering 60,000 cubic feet of air per minute, and driven by a separate induction motor, will be provided.

ELECTRICAL EQUIPMENT FOR CHINA.—Mr. T. Philip Terry, of Shanghai, who represents the interests of a number of American manufacturers of various machinery in the Chinese markets, is at present in the United States, partly with a view to placing some fair-sized contracts for electrical equipment, etc. Mr. Terry can be reached through Mr. George W. Neff, New York representative of the Stilwell-Bierce & Smith-Vaile Company, Washington Life Building, Liberty Street.

THE NEW NIAGARA POWER HOUSE.—The Buffalo contractors, Mosier & Sons, have begun work on a new power house for the Niagara Falls Power Company at Niagara Falls. The new building will be located across the street from the present house, and will cost $250,000. The building will be of Queenston limestone, 570 ft. long, with a capacity of 50,000 horse-power.

THE INTERNATIONAL POWER COMPANY has secured control in this country of the manufacture of the Diesel oil engine. The Diesel rights for the United States are owned by a syndicate connected with International Power, the American Locomotive Company, and allied interests. The International Power Company intends to manufacture Diesel engines at South Worcester.

ORDERS FOR HARRISBURG ENGINES received at the New York offices include two 200-hp standard engines for the new plant of the American Consolidated Pine Fibre Company, of Cronly, N. C., to be direct connected to 160-kw generators furnished by the General Electric Company. This outfit will be utilized for both light and power purposes. The De Lamar Copper Company's new works at Perth Amboy, N. J., are to be equipped with one 160-hp and one 80-hp Harrisburg standard engine direct connected to 100-kw and 50-kw generators built by the Crocker-Wheeler Company. The Augur & Simon Silk Dyeing Company, of Paterson, N. J., has ordered a 40-hp standard engine, to be direct connected to an Ellwell-Parker generator for lighting. The large hotel building under construction at 124th Street and Seventh Avenue is to be equipped with one 80-hp and one 45-hp standard engine, direct connected to 50-kw and 30-kw generators of Sprague make. These machines are intended for lighting purposes. Another lighting outfit is to be supplied R. Neumann & Co., Hoboken, who have requisitioned for an 80-hp standard engine direct connected to a Westinghouse 50-kw generator. Further domestic contracts now on hand include two tandem compound Ideal engines of 40 horse-power each, direct connected to 25-kw General Electric generators for lighting purposes on board the new Pennsylvania Railroad ferryboat now being constructed. The Morse Building, 140 Nassau Street, is to be furnished with a 90-hp and a 45-hp power standard engine direct connected to 60-kw and 30-kw Westinghouse generators for a lighting plant. The State Normal School at Stroutsburg, Pa., is to have a 40-hp standard engine, direct connected to a 25-kw Eddy generator. The Hall Building, 130th Street and Park Avenue, is to be equipped with a 60-hp standard engine direct connected to a 40-kw Westinghouse generator. The Wilkesbarre & Bethlehem Railway has ordered a 40-hp standard engine, direct connected to a 25-kw Westinghouse generator. This outfit will be utilized for driving exciters. The Herald Square Hotel people have ordered a 150-hp standard engine to be direct connected to a 100-kw Sprague generator for lighting the large addition now being built.

TELEPHONY IN WASHINGTON.—Secretary T. W. Tyrer, of the Telephone Company of America, announced last evening that his company will endeavor to secure from Congress this winter a franchise for an additional telephone system in Washington. If constructed it will cost $3,500,000, and will furnish employment to 1500 people. It is the intention of the company to establish 100,000 telephones in the city of Washington. No charge will be made for the installation, and no contracts for specific periods will be made. Each time the telephone is used, however, it will cost 2 cents. Telephones will be put in rooms in the hotels, and the houses of the poor will be furnished as well as the houses of the wealthy. In addition to the above important announcement the Telephone Company of America also announced that it had decided to establish the factory for making its instruments in Washington. A deal was closed last week whereby at the end of four months from that date, the telephone company will come into possession of the property belonging to the Metropolitan Railway Company at the western end of the P Street Bridge over Rock Creek. It is understood the consideration was $200,000, and that the telephone company has made one payment and will make another before taking possession of the building as a factory. The company's board of directors is composed of Messrs. John F. Betz, of Philadelphia, president of the Betz Brewing Company; William C. Kean, business manager for the Betz Brewing Company; S. B. Rinehart, president of the Frick Manufacturing Company and of the Citizens' National Bank of Waynesboro, La.; Daniel Shockey, also of the Frick Manufacturing Company; J. P. Andree Mottu, of Mottu, De Witt & Co., bankers, of Norfolk, Va.; H. J. Van Hammert, of Colorado Springs, Colo.; C. W. Vanderhoogt, Ellis F. Frost, and T. W. Tyrer, of Washington, and David F. Marvell, of Wilmington, Del. The officers of the company are: President, Mr. Rinehart; first vice-president, Mr. Vanderhoogt; second vice-president, Mr. Shockey; treasurer, Mr. R. H. Mottu; secretary, Colonel Tyrer; general counsel, Mr. Leon O. Bailey. The chief electrician, Mr. U. H. Balschey, and the chief engineer, Mr. Ellis F. Frost, were with the Bell Telephone Company for several years.

NEW ENGLAND TELEPHONE EXTENSION.—As already announced the Southern New England Telephone Company directors will, at the annual meeting of the stockholders next January, ask for authority to increase to $5,000,000 the present stock, which amounts, with the recent issue of $230,000, to $2,990,000. The new stock presumptively will be issued from time to time in such amounts and ratios as the directors see fit. The company, which occupies all Connecticut except the town of Greenwich, has the legal right by vote of the stockholders to increase stock up to $5,000,000. The Bell Company owns 34 per cent of the stock outstanding. The new stock, when issued, will be used in extending the plant. The plans for extension which are officially given out include the building of a new line between Hartford and New London, about 50 miles, to cost about $35,000; the stringing of 12 new wires between New Haven and Hartford; new buildings for exchanges in New Haven, Bridgeport, Derby, Putnam, Simsbury and Enfield; and a general increase of toll-line wires, nearly doubling the facilities for that business in the State.

POWER AT SAULT STE. MARIE.—Mr. F. H. Clergue, of Sault Ste. Marie, who is at the head of a dozen or more mammoth commercial enterprises, has practically decided upon the construction of another water power canal to cost upward of $2,000,000. Associated with Mr. Clergue in the work are Messrs. Widener and Elkins, the Philadelphia capitalists, who, it is understood, will finance half the project. The canal is intended to develop about 20,000 horse-power electrically in the rapids or falls of St. Mary's River, opposite the ship canal. The St. Mary's Falls Power Company has been organized for the purpose, and it has applied to the Board of Supervisors for permission to divert the waters of the river for the project. The plans contemplate the construction of two parallel dikes on the bed of the rapids, 150 ft. west of the line of the international bridge, which crosses the falls. The dikes will be 3100 ft. long and the lateral distance between them 480 ft. The fall of water will be about 18 ft. The water power developments now made and projected at the Canadian Sault will furnish 125,000 horse-power.

THE COPPER SITUATION.—In spite of much talk, the copper market remains about the same. On the Stock Exchange, reports were circulated that it is intended to reduce the schedule price of copper to 12 cents per pound this week; but the circles where these rumors originated were two weeks ago positive that the price would then be reduced at once to 11 cents. None of the Wall Street statements agree with either the trade reports or the statements made by the managers of different copper companies. These interests united in stating that the copper situation was materially improved. One copper firm stated last Saturday that the output is being steadily taken at the selling agents' fixed price, and that urgent inquiries continue from the General Electric Company and the Ansonia district, but that these consumers have been unable to obtain a concession of even ⅛ cent per pound. The president of one of the independent copper companies flatly asserted that fully one-half the stock on hand could be placed at once if the agents agreed to that concession.

BALL ENGINE SALES.—The Pacific Coast Company, Seattle, Wash., are installing an engine furnished by the Ball Engine Company, Erie, Pa. The Cleveland Macaroni Company, Cleveland, Ohio, have purchased an engine for electric lighting from the Ball Company. The Driskill Hotel, of Austin, Texas, has ordered from the Ball Engine Company a direct-connected engine for its electric plant. The College of Physicians and Surgeons, Chicago, will have an electric plant. The power will be furnished by a Ball engine.

ELECTRIC HEADLIGHTS.—Contracts have been let for the equipment with electricity for headlights of all the passenger engines of the Chicago & Alton Railway. The power will be derived from a small dynamo placed on top of the engine behind the smokestack. The new headlight, it is claimed, will throw a light clear enough to distinguish any object 2000 ft. ahead of the locomotive. The present oil lights do not reach further than 700 ft.

ELECTRIC AUTOMOBILE RECORD.—A cable dispatch from Paris of Oct. 19 states that the record for long distance accomplished without recharging the accumulators of an electric automobile was beaten on the 16th by Mr. Krieger with a machine of his own well-known manufacture. He went from Paris nearly to Chateau l'Erault, a distance of 307 kilometres, with one charge of the batteries. The previous best is 262 kilometres by Garcier.

NEW STURTEVANT FACTORY.—Work is now under way upon the foundations for the immense new plant of the B. F. Sturtevant Company, at Hyde Park, Mass. That the buildings can be completed none too soon for the urgent needs of the company is evidenced by the fact that their present plant at Jamaica Plain, Mass., is now taxed to the limit and that it has been necessary to run overtime, particularly in the engine and electrical departments.

CLEVELAND OFFICE FOR THE S. K. C. SYSTEM.—The Stanley Electric Manufacturing Company has opened offices in the New England Building, 129-131 Euclid Avenue, Cleveland, Ohio. Mr. Alexander T. Moore, formerly of Pittsburg, has been appointed district manager.

BRITISH THOMSON-HOUSTON COMPANY, LIMITED, representing as a distinct organization the General Electric Company in England, has moved its head office from 83 Cannon Street, London, to its new works at Rugby. The production of high grade and heavy electrical machinery begins forthwith at the new factory.

General News.

THE TELEPHONE.

BIRMINGHAM, ALA.—The Hillman Hotel, just completed, is equipped with a private system of telephones, 240 in number.

OPELIKA, ALA.—A long-distance telephone line has been completed from Lafayette to Roanoke, thereby completing a telephone service from Opelika to Roanoke.

ROGERSVILLE, ALA.—J. Ross Patterson, J. M. Bedingfield, J. A. Lentz and others have awarded a contract to John A. Pruitt for the construction of a telephone system.

CARDIFF, ALA.—The Southern Bell Telephone Company has been granted a franchise to construct a telephone line to Cardiff and Brookside, adjoining the Birmingham lines.

SCOTTSBORO, ALA.—The Cumberland Telephone Company has raised the rate on business telephones to $1.50 per month. All the business houses in town refuse to pay the increased rate.

FLORENCE, COLO.—The Colorado Telephone Company at Florence reports that business has increased over 50 per cent during the last six months in the district embracing Canon City and Florence and the coal camps, which now have more than 400 resident and business telephones.

ATHENS, GA.—The Southern Bell Telephone Company is arranging for a right of way for a telephone line between Athens and Elberton, which the company intends building at an early date.

MONMOUTH, ILL.—The Monmouth Telephone Company will improve its plant by putting in cable extensions.

BEARDSTOWN, ILL.—The citizens of this place are agitating the question of a telephone franchise for the Virginia & Little Indian Telephone Company.

MANHATTAN, ILL.—A new stock company is being formed by members of the country telephone lines, and will be known as the Manhattan Telephone Company.

BLOOMINGTON, ILL.—Farmers in Pike township, Livingston County, have established a telephone system. The line will connect Chenoa, Graymont, Waldo and Ocoya.

HIGHLAND, ILL.—At the City Council meeting a representative of J. A. Stiennan appeared before the Council and asked for a franchise to construct a telephone exchange.

LOVINGTON, ILL.—Mr. C. A. Gregory is operating a telephone system here with 85 subscribers. He has recently built 30 miles of metallic circuit and 25 miles of grounded toll lines.

MARENGO, ILL.—Representatives of the Chicago Telephone Company have been in this vicinity recently and have succeeded in securing enough subscribers to warrant the company in putting in an exchange here.

CHICAGO, ILL.—The strike of the linemen and repairmen of the Chicago Telephone Company for increase of wages, which began on Oct. 1, is still unsettled. The strike extended to Springfield, Joliet, Aurora, Elgin and other places About 400 men in all went on strike. The company announced that it would not treat with the men as a union, but as individuals. The union declined to accept the proposition of the company.

INDIANAPOLIS, IND.—The South Whitley Telephone Company increased its capital from $3,000 to $15,000.

CLAY CITY, IND.—The Central Union Telephone Company is putting in a system here under a franchise granted two years ago.

PERU, IND.—The County Commissioners have granted a franchise to the Grimes Telephone Company to operate in Denver and vicinity and the Home Company to operate in and out of Peru.

EVANSVILLE, IND.—Capitalists of Chicago, Lafayette, Ind., and Evansville have purchased the District Telegraph plant in this city, and will establish an independent telephone exchange here.

MARION, IND.—Plans have been prepared by a local architect for a building to be erected by the United Telephone Company which recently acquired possession of the independent system in this city, as well as the plants of Bluffton, Portland, Montpelier, Hartford City, Upland and the connecting toll lines.

COLUMBUS, IND.—A combination has been formed to patronize only one telephone service in this city. The butchers and grocers have entered into an agreement to discontinue the use of the Bell telephone at their places of business, at the expiration of their contracts. The merchants have taken similar steps. They give no other reason than that the keeping up of two telephones is a useless expense, and that their customers cannot longer force them to do so. The Citizens' system will be patronized. This system has over 500 telephones in use in the city, and nearly that many more on lines extending into different parts of the county. The Bell Company, it is claimed, has but 300 subscribers in the city and very few rural district patrons, which is regarded as a disadvantage to the merchants. It is highly probable that the Bell Company will endeavor to break the combination, and if so a rate war is inevitable.

INDIANAPOLIS, IND.—There was much interest and concern taken by the citizens of this city recently because of a rumor that the Central Union Telephone Company was quietly but surely assimilating the New Telephone Company by buying up the stock of the smaller holders. President Sheerin, of the New Telephone Company, was repeatedly asked for a verification, and gave out the following: "The bulk of the stock in our company could not by any means be touched by other persons, and there is a general understanding that the smaller holders shall not sell their stock. The Central Union owns not a share of our stock to my knowledge. It would be highly more probable that we should buy the Central Union stock, and we would do it gladly if we could. The recent development in the independent telephone movement all over the country make the rumor of our selling out laughable," he said.

CLARINDA, IA.—A new rural telephone system is being organized here.

CHARITON, IA.—The Chariton Telephone Company's central office is being equipped with new wires and new cables throughout, to accommodate the largely increasing patronage of the office.

DES MOINES, IA.—Articles of incorporation were filed at Des Moines by the Woolstock Telephone Company. Its capital is $5,000. C. H. Clifton, president; M. Wallin, J. C. Smith, G. W. Olmstead and W. S. Chatman are the incorporators.

SOUTH MACALESTER, I. T.—The North American Telephone Company will construct a line from South MacAlester to Denison, Tex., and from the latter place to Holdenville.

DE SOTA, KAN.—The De Sota Telephone Company has been incorporated with a capital stock of $5,000.

WETMORE, KAN.—The Wetmore Telephone Company has been incorporated; capital stock, $5.000.

LEAVENWORTH, KAN.—The Missouri & Kansas Telephone Company on Oct. 1 increased the rental of its telephones to $3 per month. The raise will not affect the residence telephones.

KANSAS CITY, KAN.—The Missouri & Kansas Telephone Company has moved into its new exchange at the corner of Sixth Street and Armstrong Avenue. The new exchange is equipped with the central energy system.

FORT SCOTT, KAN.—Grant Hornaday, C. W. Penniman and other Fort Scott officers and members of the Kansas Telephone Company, will make another effort to get a franchise at Wichita. An ordinance has been presented to the Wichita Council.

MIDDLEBURG, KY.—A telephone line is being built from Mintonville to Humphrey, where connection will be made with the line to Middleburg.

SPRINGFIELD, KY.—The Washington County Telephone Company has begun extensive improvements in its lines and a better service will be given.

PADUCAH, KY.—The Cumberland Telephone Company, which has just ordered a new line from Paducah to Joppa, Ill., is to make further improvements and extensions.

LUDLOW, KY.—The Kentucky Telephone Company, of Ludlow, has been incorporated, with a capital stock of $5,000. William R. Shiners and John S. McCormick are the incorporators.

NEW ORLEANS, LA.—The Telephone Company of America is seeking to establish itself in New Orleans and an ordinance is before the City Council applying for a franchise.

CENTERVILLE, MD.—The Diamond State Telephone Company will lay a cable across Chesapeake Bay to establish telephone communication between Centerville and Baltimore.

BALTIMORE, MD.—A controlling interest in the Worcester Telephone Company, of Snow Hill, has been purchased by parties representing the Eastern Shore Telephone Company, of which Harry A. Richardson, of Dover, is president.

WEST NEWBURY, MASS.—A project is on foot to establish a telephone system here.

BOSTON, MASS.—The Fall River Automatic Telephone Company, organized under Massachusetts laws, with $135,000 capital stock, has started operations in Fall River, with 506 subscribers. It charges $36 per annum for business telephones and $24 for residences. The New England Company's charges in Fall River range from $25 to $90. Among the directors are B. D. Davol, E. B. Jennings and R. P. Borden. This company will be connected with the Telephone, Telegraph & Cable Company system connecting New York and Boston.

EVART, MICH.—The Evart Citizens' Telephone Company has extended its line to Temple, Mich. This gives Temple connection with the State lines of all independent telephone lines.

SAGINAW, MICH.—The Union Telephone Company will place Midland in communication with Jam, Coleman, North Bradley, Sanford and Averill, points not heretofore reached by telephone. A branch line will be built from Averill to Hope and Edenville.

IONIA, MICH.—As a result of the franchise given the Citizens' Telephone Company of Grand Rapids for a new exchange, the company has commenced work preparatory to putting in 30,000 feet of underground conduits, running under the entire length of the main street pavement. It states that $75,000 will be spent at once getting the exchange started. The exchange will have 200 or 300 subscribers.

MANKATO, MINN.—The directors of the Mankato Citizens' Telephone Company contemplate important improvements.

KENYON, MINN.—The farmers between Kenyon and Aspelund have organized the Farmers' Mutual Telephone Company, and will build a line connecting these two points this Fall. Their intention is to extend the line from Aspelund to Zumbrota.

MERIDIAN, MISS.—It is reported that the local telephone company has sold out to the Cumberland Telephone Company.

WEST BOWAN, MO.—There is talk of a new telephone line being run from Tucker to Humphreys.

CLINTON, MO.—The Mutual United Telephone Company will soon complete a line to Leesville, Coal, Hortense and the eastern part of the county.

MOUNTAIN GROVE, MO.—The Wright County Telephone Company, of Mountain Grove, has been incorporated; capital stock, $2,500. Incorporators: J. H. Medley, J. D. McComb, W. C. Dugan, and others.

MONROE, N. C.—There is talk of establishing a telephone system here. It is said that $1,000 worth of stock has already been subscribed.

JAMESTOWN, N. D.—A final adjustment has been made by Receiver James A. Murphy, of Jamestown, in the affairs of the North Dakota Telephone & Electrical Company and the creditors will receive 80 cents on the dollar. The liabilities of the company amounted to $4,400.

MIDDLETOWN, N. Y.—The Wallkill Telephone & Construction Company has been incorporated; capital stock, $12,000. Directors: G. W. Ballou, of Wawayanda, and J. G. Harding and T. D. Mills, of Middletown.

NEW YORK, N. Y.—The constituent companies of the Telegraph, Telephone & Cable Company, of America, which has recently come into the control of Mr. C. W. Morse are: Knickerbocker Telephone & Telegraph Company; capital stock, $7,500,000. Boston & New York Telephone & Telegraph Company; capital stock, $5,000,000. Continental Telephone, Telegraph & Cable Company; capital stock, $1,000,000; New Rochelle & Westchester Telephone Company; capital stock, $150,000. Telephone, Telegraph & Cable Company of Eastern New York; capital stock, $100,000. Anderson Telephone Company; capital stock, $50,000. Massachusetts Telephone & Telegraph Company; capital stock embraced in the $5,000,000 of the Boston & New York Telephone & Telegraph Company. The parent company was chartered on Nov. 13, 1899, in New Jersey. Its capital stock was then $30,000,000.

JACKSON, OHIO.—The Jackson Center Telephone Company has been incorporated, with a capital stock of $6,000.

CLEVELAND, OHIO.—The Federal Telephone Company will issue bonds on properties now under construction in Detroit, Dayton, Mansfield, Canton, and several smaller towns.

SHELBY, OHIO.—The People's Telephone Company, of Shelby, is preparing to build a branch exchange at Tiro. About 150 contracts have been secured in the town and surrounding country.

HILLSBORO, OHIO.—The exchange of the Hillsboro Home Telephone Company, will soon be ready for operation. A new multiple switchboard, built by the American Electric Telephone Company, is being installed.

DAYTON, OHIO.—John B. Pierce has been made general superintendent of construction at Dayton in place of W. C. Pickett, who has been appointed superintendent of construction for the United States Telephone Company.

CINCINNATI, OHIO.—A new exchange has been installed in the County Court House. An odd feature of the installation is that all the Superior Court Judges have refused to permit telephones to be placed in their rooms.

CLEVELAND, OHIO.—A summary of the report of the Cuyahoga Telephone Company for August is as follows: Gross earnings, $27,440.83; operating expenses, $15,047.22; net earnings, $12,393.61; fixed charges, $10,358.33; surplus, $2,035.28.

CLEVELAND, OHIO.—The report of the United States Telephone Company for August shows the following results: Gross earnings, $16,388.65; operating expenses, $8,212.44; net earnings, $8,176.21; fixed charges, $7,315.46; surplus, $860.70.

CINCINNATI, OHIO.—The incorporation of the Kentucky Telephone Company has been recorded in Covington. The incorporators are Wm. Cheifers, John S. McCormick, Michael Glore, and J. J. Weaver. The capital stock is $5,000. The office will be located at Ludlow, Ky.

ALLIANCE, OHIO.—The Stark County Telephone Company has commenced cutting in its exchange at Alliance, and about 200 lines are now in service. The switchboard has been completed, but the work of connecting up the balance of the system has been delayed through non-delivery of cable.

LANCASTER, OHIO.—The Lancaster Telephone Company, one of the properties of the Federal Telephone Company, makes the following statement of earnings for eight months. Gross earnings, $4,777.62; expenses, $1,910.17; net earnings, $2,867.45; taxes and interest, $901.08; surplus, $1,966.37.

DAYTON, OHIO.—The Dayton Home Telephone Company will open its exchange with not less than 3000 subscribers, nearly that number having already been secured. Work on the underground system is being pushed in order to complete it before the cold weather. About 300,000 feet of duct will be laid down.

CLEVELAND, OHIO.—J. B. Hoge, chairman of the board of directors of the Federal Telephone Company, says that the business of the various exchanges of the company throughout the State is making unexpected progress, and the next six months will undoubtedly break all records for the company in the way of revenue gains.

CLEVELAND, OHIO.—The Postal Telegraph Company has made arrangements with the United States Telephone Company to utilize its franchises and pole lines in entering East Liverpool, Columbiana, Salem and a number of other towns in Columbiana County, Ohio. Heretofore the Western Union Telegraph Company has had a monopoly in this section.

LANCASTER, OHIO.—The Lancaster Telephone Company has organized for the year as follows: J. B. Hoge, president; Frank L. Beam, vice-president and general manager; W. H. Park, treasurer; W. E. Baker, secretary. The above, with Maxime Reber, and W. B. Woodbury constitute the board of directors. The company is controlled by the Federal Telephone Company, of Cleveland.

FINDLAY, OHIO.—The telephone linemen's strike has been declared off and the men have returned to work. The difficulties were settled through the efforts of President Wheeler, of the International Electrical Workers' organization, who came from Rochester, N. Y. The plant becomes a union one and in return the strikers withdrew their ultimatum requiring the discharge of Manager Duval.

CLEVELAND, OHIO.—K. V. Murrey, well known in the independent field as traffic manager of the United States Telephone Company, has resigned, to accept the position of general manager of the United Telephone Company of Bluffton, Ind. The company has eight important exchanges in the vicinity of Bluffton, and owns several hundred miles of toll lines connecting towns in that section of Indiana.

FINDLAY, OHIO.—Recently the city authorities cancelled their agreement with the Central Union Telephone Company, for service in school buildings, and took up the independent service. The Central Union Company declined to remove the lines until the contracts expired and the teachers have been notified not to use the telephones, and in order to present their use, the instruments and bells have been stuffed with cotton.

AKRON, OHIO.—The telephone linemen's strike at Akron has become a waiting game. The companies claim they have enough men to keep the lines in condition, but they can not do new work. The strikers claim that the Bell companies in Ohio, Indiana, Illinois and Iowa are standing together to break away from union employes, and that they have centered the fight in Akron and will contribute to win the battle at that point.

CLEVELAND, OHIO.—The Cuyahoga Telephone Company is now averaging installations at the rate of nineteen per day from its central and branch exchanges. The company now has about 9,000 telephones in operation, which it is claimed makes this the largest independent exchange in the country. A branch exchange has recently been installed for the Big Four Railway at Linndale, connecting all its shops and offices in that place.

CLEVELAND, OHIO.—The Springfield Home Telephone Company, which is composed of Cleveland people, with headquarters in the Garfield Building, is placing contracts for much of its material. Poles and wire have recently been purchased, but the switchboards and instruments are not yet contracted for. The company is breaking ground for a handsome four-story exchange building. Work in securing contracts is progressing favorably.

MARIETTA, OHIO.—The Marietta Telephone Company has been sold to the West Virginia Western Telephone Company, of Parkersburg, of which Senator H. C. Henderson, of Williamstown, is president; J. H. Lunnger, of Harrisville, W. Va., secretary; A. C. Davis, of Parkersburg, general manager, and F. P. Moats, of Parkersburg, attorney. After the transfer of stock the following directors were elected: A. L. Gracey, J. Torner, W. H. Jett, H. C. Henderson, J. H. Lunnger and F. P. Moats. Officers were elected as follows: A. L. Gracey, president; A. C. Davis, secretary and manager; W. D. Dunning, the former manager retiring. It is expected that the Marietta company will be merged into the purchasing concern. The central office will be maintained here and connection be given with over 1000 towns in West Virginia.

HAMILTON, ONT.—The Bell Telephone Company has just completed two new through lines from Hamilton to Toronto Junction.

OTTAWA, ONT.—The Canadian Minister of Public Works has decided upon a change in the rates to be charged on the government telegraph lines to the Yukon. The rate for press despatches, instead of being $3 per 100 words, as at present, will be $1 per 100 words. Cable rates from the Yukon will also be altered. The old minimum rate of $3 a despatch will be done away with entirely, and there will be no minimum rate. Instead, a toll of 40 cents a word will be charged. The question of commercial rates is still under consideration.

RIDLEY PARK, PA.—The United Telephone Company has applied to Council for permission to extend its lines in the borough.

CARLISLE, PA.—The Southern Pennsylvania Telephone Company, with headquarters at Carlisle, will decide by a vote of stockholders here, with the Dauphin County, Adams County, Hanover and Cumberland Valley Telephone Companies, to form a company to be known as the Cumberland Valley Telephone Company, with offices at Harrisburg, Pa.

PROVIDENCE, R. I.—The ordinance granting permission to the Providence Telephone Company to lay conduits, and in certain streets of the city was passed by the Common Council.

ORANGEBURG, S. C.—Orangeburg & St. Matthews Telephone Company, capital stock $1,500, has been incorporated by W. H. Dukes, A. C. Andrews and W. C. Wolfe.

ABERDEEN, S. D.—The Dakota Central Telephone Company will extend its lines to Bismarck via Mound City.

COLTON, S. D.—The Colton Telephone Company, capital stock $10,000, has been incorporated by O. P. Anderson, Martin Larson, A. T. Austin, J. E. Colton and others.

ABERDEEN, S. D.—The capital stock of the Dakota Central Telephone Company will be increased from $100,000 to $500,000. This means improvements in lines already built and the further extensions.

COURTLAND, TENN.—An effort is being made to establish a telephone exchange here.

ROCKWOOD, TENN.—The Cumberland Telephone Company has purchased the local exchange of the Roane County Telephone Company.

WEATHERFORD, TEX.—A franchise has been granted to the O. R. Riddle Independent Telephone Company.

BRENHAM, TEX.—The Campbell, Grace & Mayfield Telephone Company has been granted the right to operate a telephone line within the territorial limits of the city.

SHERMAN, TEX.—The Indianola Telephone & Telegraph Company has filed a charter. The company proposes to build exchanges in a number of counties in the State.

BEAUMONT, TEX.—The Beaumont-Northwestern Telephone Company, capital stock $10,000, has been incorporated to carry on a telephone business in the counties of Jefferson, Liberty, Hardin, Orange, Chambers, Jasper, Tyler, Newton, Sabine, San Augustine and Nacogdoches. The incorporators are J. M. Smith, W. R. Bruce and John Hator.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone Company is laying a large amount of conduit in Salt Lake City.

SALT LAKE CITY, UTAH.—Arrangements have just been made whereby connections with the lines of the Opal and Big Pinney Telephone Company can be had. These lines run north of Opal, Wyo., to Big Pinney, connecting with a number of sheep camps.

RICHMOND, VA.—The Bell Telephone Company has purchased the Virginia Long-Distance Company, whose office is at Staunton and whose lines run from Harrisonburg to Bristol and to Charlottesville and Lynchburg.

RICHMOND, VA.—Mayor Taylor has vetoed the Bell franchise in accordance with a previous declaration. The Bell Company, however, it is stated, has a majority in both the Board of Aldermen and Common Council, and will have a meeting called to pass the franchise over the Mayor's veto.

HUBBARDTON, VT.—The Cornwall Telephone Company is extending its line south and will connect with the Clemmons line at Bomosseen.

PARKERSBURG, W. VA.—The entire system of the Marietta Telephone Company, comprising 800 connections, was purchased by Parkersburg capitalists who will consolidate it with the West Virginia Western Telephone Company.

GRAFTON, W. VA.—The Independent Telephone Companies of Central West Virginia have combined and will be known as the Central West Virginia Telephone Exchange, with H. C. Henderson, of Parkersburg, president; P. W. Lowe, of Mannington, first vice-president; J. I. Alexander, of Clarksburg, secretary and treasurer.

CHIPPEWA FALLS, WIS.—The Chippewa County Telephone Company has increased its capitalization from $3,000 to $30,000.

MARSHFIELD, WIS.—A company has been formed in the town of Masonville for the purpose of establishing a telephone line.

GREENWOOD, WIS.—H. H. Heath, of the Badger State Telephone & Telegraph Company, of Neillsville, is installing a local exchange and toll line.

KENOSHA, WIS.—One hundred residents of this city will bring suit against the Wisconsin Telephone Company asking damages for poles set in front of their property.

LACROSSE, WIS.—The Twin City Telephone Company will construct an independent long-distance line of copper between St. Paul, Minneapolis and La Crosse, the improvements to cost in the neighborhood of $250,000.

RACINE, WIS.—At the annual meeting of the stockholders of the Citizens' Telephone Company it was shown that 805 telephones were in use; that the earnings of the company were largely in excess of the expenses and that although no dividend had been declared, it was probable that one would be declared soon. There was a feeling in favor of extending the business as rapidly as possible and hopes that there would soon be toll service with the larger cities. Officers were elected as follows: President, John B. Simmons; Vice-President, E. B. Belden; Secretary, Gustave V. Kradwell; Treasurer, Charles Carpenter; Directors, G. V. Kradwell, Joseph Breese, J. P. Davies, Dr. Robert Kitto and Dr. Sorenson.

BUFFALO, WYO.—A company has been organized to construct and operate a telephone line between Buffalo, Kaycee and Mayorworth.

ELECTRIC LIGHT AND POWER.

FLORENCE, ALA.—A franchise has been granted to M. C. Buxbaum and others for an electric light and street railway plant. Mr. Buxbaum is representing Northern parties. The city has been without electric lights for six years.

SAN FRANCISCO, CALIF.—The Corona Gas & Electric Company has been incorporated, with San Francisco named as the principal place of business. Directors: J. G. Whitson, A. Harris, H. M. Pabst, L. M. Thompson and P. L. Benjamin. Capital stock, $50,000; subscribed, $50.

DENVER, COLO.—The San Juan Electric Light & Railway Company has been incorporated in Denver, with a capital of $300,000. It will operate in Ouray County. A. S. Thursten, S. T. Hamilton, W. R. Monson, G. A. Taff and J. A. Barclay are the incorporators.

AUGUSTA, GA.—Stewart Phinizy and others have been granted a franchise to furnish electricity and gas in the city.

ROSEWELL, GA.—The Rosewell Cotton Mills will increase the height of its dam, and a movement is said to be on foot looking to the using of some of the extra power for electric lighting in the town.

ALTON, ILL.—It is said that contracts have been let for the equipment of every passenger engine on the Chicago & Alton Railroad with electric head lights. The Alton is the first road in the country to entirely displace oil with electricity.

INDIANAPOLIS, IND.—The Western Electric Engineering & Construction Company, of Indianapolis, has increased its capital from $10,000 to $20,000.

PAOLA, KAN.—The Franklin Light & Fuel Company has been incorporated, with a capital stock of $2,200.

EMPORIA, KAN.—Emporia is to increase the electric plant, which is owned by the city, so as to be able to furnish power for manufacturing plants both day and night. It is also contemplated to put in a street car system, the power to be furnished by the city, and possibly the city to own the street car line.

LAKE PROVIDENCE, LA.—The Board of Aldermen has ordered an election to be held Nov. 1 on the question of issuing $20,000 5 per cent bonds for a system of waterworks and electric lights.

PORTLAND ME.—The plant of the Portland Lighting & Power Company was recently damaged by fire.

SALISBURY, MD.—The sale of the Salisbury, Md., electric light works by the Messrs. R. M. and W. T. Johnson to a syndicate of New York capitalists is announced. The price paid is said to have been $40,000.

BOSTON, MASS.—The gas commissioners have authorized the Cambridge Electric Light Company to issue $50,000 new stock at $140 per share, the proceeds to be expended for additions to plant.

CLINTON, MO.—There is an opening in this town for an electric light plant.

ST. LOUIS, MO.—The Terminal Association is preparing to substitute electric power in the operation of its tunnel fans.

ST. LOUIS, MO.—The Mound City Motor Company, of St. Louis, has been incorporated with a capital of $2,000. The incorporators are John J. Mielke, Edward Doyle, George Bonney and W. J. Perkins.

ST. LOUIS, MO.—The annual convention of the International Brotherhood of Electrical Workers convened here Oct. 21 and will continue through the 28th. It is said that a demand will be made for a wage increase all over the country.

CARSON CITY, NEV.—A company has been formed at Reno to tap the wires of the Truckee River Electric Power Company and distribute energy throughout the town of Reno for lighting, heating and power purposes. Farmers in Mason Valley, Lyon County, have incorporated a company to put in an electric plant on the Walker River and have secured the water rights, etc., preparatory to the commencement of active work. Carson Valley farmers are also establishing a plant on the Carson River, near Gardnerville, Douglas County, where there is ample fall. They expect to supply power for adjacent mines and also for a new electric railway to be built through the Carson Valley from Carson City to the mines in Mono and Alpine counties, California.

NEWBERN, N. C.—A second election on the question of issuing $15,000 electric lighting bonds has been called by the City Council for Dec. 3. The town is at present in darkness, but a temporary contract may be made later with the present electric light company.

RALEIGH, N. C.—If the weather permits it is expected that electric power from Milburnie, on the Neuse River, six miles distant, will be delivered in the city within three weeks. Two hundred and seventy-five horsee-power will be developed at first, although the water wheels are of 900 horse-power. T. L. Eberhardt and E. C. Hillyer are interested.

BERNARDSVILLE, N. J.—Plans have been sent out to local builders for estimates on a large power-house to be erected in this place for the Bernardsville Heat, Light & Power Company. The plans were drawn by the company's engineer. A new power plant is to be installed, costing $20,000.

SPRINGFIELD, OHIO.—The Horn Lighting, Power & Heating Company, of Springfield, has been incorporated, with $100,000 capital stock, by E. S. Kelley, J. E. Bowman, J. A. Linn, H. E. Schenck and Alfred Cavileer.

CINCINNATI, OHIO.—The village council of Madisonville has authorized the holding of a special election on Nov. 11 to determine the question of issuing $25,000 worth of bonds for the improvement of the electric light plant and water works.

OTTAWA, ONT.—The Canadian General Electric Company has arranged with the Dominion government to develop power at Nassau Mills for use in the Peterboro works of the company. Nassau Mills is on the canal about three miles above Peterboro.

OTTAWA, ONT.—The Stave Lake Power Company, of Vancouver, B. C., has completed its negotiations with Eastern capitalists for the financing of the proposition. The money for the development is being furnished by Stone & Webster, of Boston, Mass., and work will begin at once in connection with the installation of the plant. Power will be transmitted to Vancouver and New Westminster. The cost of the work is estimated at $650,000, including $280,000 for a tunnel two miles in length, dam, etc., and $370,000 for generating plant, and pole line.

BAKER CITY, ORE.—The company, which supplies electric light and power in Baker City, recently ordered a quantity of new machinery, which will be set up within a short time, and will greatly improve the service.

PITTSBURG, PA.—The Keystone Electric Company, composed of Braddock capitalists, has begun the erection of an electric light and power plant. It will be a rival to the Monongahela Light & Power Company, which furnishes light, heat and power to the boroughs of Braddock, Rankin, North Braddock, Turtle Creek, East Pittsburg and Wilmerding. The Keystone company has a capital of $100,000. The officers are: Justice Frank T. Redman, president; John Gangwisch, secretary, and Harvey McKinny, treasurer, all residents of Braddock.

SPARTANBURG, S. C.—Ladshaw & Ladshaw have a contract to develop water power near Asheville, N. C., for electric transmission. Power will be used for a cotton mill and other purposes.

COLUMBIA, S. C.—The State Lighting Commission has called for bids for the electric wiring of the State house, bids to be received until Wednesday, Oct. 30, at noon. The contract for current has been made.

DENTON, TEX.—The Denton Water, Light & Power Company is arranging for the use of petroleum as fuel in the plant here.

VERNAL, UTAH, will in all probability be lit by electricity in the near future. Contracts for the plant are already under construction. James Johnson is the promoter of the enterprise.

SALT LAKE CITY, UTAH.—The County Commissioners have granted the Hercules & Telluride Power Company a permit to extend its transmission line to Bingham City. This means a great saving to consumers of this company's light and power, and a saving of $75 per month to the city.

RICHMOND, VA.—The Richmond Industrial Development Company has awarded the contract for a $35,000 plant to J. T. Wilson. The company proposes to supply electric power and floor space to small manufactories which could thrive better with these advantages supplied cheaply. The Traction Company and the Virginia Electrical Railway & Development Company are interested.

THE ELECTRIC RAILWAY.

SAN FRANCISCO, CALIF.—A Baltimore syndicate represented by T. J. Blackwell and associates, recently asked for a definite figure on the sale of the street railway between San Jose and Santa Clara, Calif., and also on the motor line from San Jose to Alum Rock Park.

AUBURN, CALIF.—The new street railway line of the Auburn Electric Railway Company was recently completed. The event was celebrated by the citizens under the direction of Superintendent A. S. Moore. Two gold spikes were driven and a barbecue and ball followed.

DENVER, COLO.—It has been practically settled that the Colorado & Southern Railroad will install electricity as a motive power on all its suburban lines running out of Denver.

CHICAGO, ILL.—The West Michigan Traction Company has been formed at Chicago, with a capital of $1,000,000.

LOGANSPORT, IND.—The Wabash River Traction Company, now operating a line between Wabash and Peru, has asked the County Commissioners for a right of way through Cass County.

SPRINGFIELD, ILL.—The Illinois River Railway, Light & Power Company, Ottawa, capital $2,000,000, has been incorporated by Josiah Cratty, William H. Duval and Edward J. Hamel.

SHELBYVILLE, IND.—Townsend, Reed & Company, of Chicago, have commenced the construction of the Indianapolis, Shelbyville & South Eastern Traction Company, from this city to Indianapolis.

MIDDLETOWN, IND.—The directors of the Muncie, Middletown & Greenfield Traction Company have ordered a survey of the line with a view of beginning construction work at once. W. H. Woods heads the board of directors.

PRINCETON, IND.—A 50-year franchise was granted to Edwin J. Baldwin, through Gibson County, for an electric railway, electric light and power-house privileges. The company recently organized proposes to erect a line from Evansville to this city, and thence to Coals Springs.

CENTERVILLE, IA.—This city will have an electric street railway system, a gas plant, an electric lighting plant and a public heating plant. All these propositions were carried at the special election, when franchises for a period of twenty-five years were granted.

CATLETTSBURG, KY.—The new long-distance line between Gallipolis and Ironton, Ohio, is nearing completion. Over two-thirds of the distance is covered and the entire work is expected to be finished within thirty days.

PITTSFIELD, MASS.—The Berkshire Street Railway Company has petitioned the city of Pittsfield for locations on roads connecting the city proper with Tillotson's, Sternsville and Lower Barkerville. The selectmen of Hancock are petitioned by the company for locations in that town to the New York State line, where the Berkshire company will be met by an Albany company, the combined roads making a through trolley road from Pittsfield to Albany, a distance of about 28 miles.

ST. PAUL, MINN.—Announcement is made that the Twin City Rapid Transit Company has secured from the Northern Pacific the right to build tracks on the right of way between White Bear and Mahtomedi, and that a new electric line will connect the two points before next summer. A survey has been made for the line and construction material has been ordered.

OMAHA, NEB.—The Douglas County Suburban Railway Company has asked the County Commissioners for a franchise for the construction and operation of a suburban line.

CARSON CITY, NEV.—Incorporation papers have been filed with the Secretary of State of a company to utilize the power of Clear Creek to operate an electric railway from Carson City to Lake Tahoe. A new plant has been completed near Winnemucca, Humboldt County.

EXETER, N. H.—The Seabrook & Hampton Beach street railway has been opened for business.

NEWARK, N. J.—The stockholders of the Worcester Traction Company, a New Jersey corporation controlling street car lines in Worcester, Mass., met here and took preliminary steps toward winding up the company's affairs. This was accomplished by adopting a resolution recommended by the Board of Directors, which provides for the cancellation of practically all of the preferred stock. Specifically the resolution calls for the reduction of the number of preferred shares from 20,000 to 400 and the redemption and retirement of the remaining 19,600 shares. It was stated that ultimately the company would go into entire liquidation, although the operation of its lines will not be interfered with for some time to come.

ALBANY, N. Y.—The State Board of Railroad Commissioners has granted the application of the St. Lawrence International Electric Railway & Land Company for authority to construct a road seven and a half miles long between Alexandria Bay and Redwood.

ALBANY, N. Y.—Daniel F. Toomey, president of the Dunkirk & Point Gratiot Traction Company, confirms the report of the sale of his line and the franchise for 99 years, to capitalists who are to construct the trolley line from Buffalo to Jamestown by way of Dunkirk.

STEUBENVILLE, OHIO.—The Pleasant Heights Electric Company, of Steubenville, has been placed in operation.

LIMA, OHIO.—The Toledo, Columbus, Springfield & Cincinnati Railway will build a passenger, freight and telegraph station in Lima.

CLEVELAND, OHIO.—A bridge over the Huron River is all that is needed to enable the Everett-Moore syndicate to operate cars from Cleveland to Detroit.

BELLEFONTAINE, OHIO.—It is announced that the Dayton, Springfield & Urbana Railway will be extended from Urbana to Bellefontaine.

FINDLAY, OHIO.—It is claimed in Findlay that overtures have been made by the Everett-Moore syndicate for the purchase of the Tiffin, Fostoria & Eastern Railway.

HAMILTON, OHIO.—The Millcreek Valley Traction Company has been enjoined from connecting two sections of its line in Glendale because it neglected to secure a proper franchise.

TOLEDO, OHIO.—The Toledo & Lima Traction Company has awarded a contract to the American Bridge Company for a $27,000 steel bridge to be erected across the Maumee River at Waterville.

CLEVELAND, OHIO.—It is stated that negotiations are under way for the purchase by the Everett-Moore syndicate of the Canton-Akron Railway, now under construction between Canton and Akron.

BARBERTON, OHIO.—A. T. Townsend, promoter of the Barberton, Doylestown & Massillon Railway, has offered to sell his franchise from Barberton to Doylestown to the Northern Ohio Traction Company.

CLEVELAND, OHIO.—M. J. Roseboro, of Cleveland, and J. Cleland and R. H. Reynolds, of Greenwich, Ohio, are securing right of way for an electric railway from Mansfield to Norwalk by way of Greenwich.

MARION, OHIO.—The Findlay & Marion Railway Company has secured a private right of way from Marion to Findlay by way of Carey and Upper Sandusky, and is now securing a 30 foot right of way from Carey to Fostoria.

FINDLAY, OHIO.—The final survey of the Western Ohio Railway from Findlay to Lima has been completed. Large shipments of ties are being unloaded along the route and several forces of men are pushing the grading.

DAYTON, OHIO.—The case of the city of Dayton vs. the Dayton City Railway Company is on trial here. It is a mandatory injunction suit brought to compel the company to use the double trolley wire system as a preventive against electrolysis.

DELPHOS, OHIO.—The Lima, Delphos, Van Wert & Ft. Wayne Traction Company which proposes to build a line from Lima to Ft. Wayne, Ind., has applied for franchises in Delphos and Van Wert. Much of the right of way has been secured.

KENTON, OHIO.—The Defiance, Ottawa, Kenton & Columbus Railway has secured private right of way through part of Union County. The road will extend from Defiance to Columbus, touching Ottawa, Kenton, Richwood, Magnetic Springs and Delaware.

ASHTABULA, OHIO.—It is stated that arrangements have been completed by the Everett-Moore syndicate for the absorption of the lines of the Ashtabula Rapid Transit Company, as soon as the Ashtabula extension of the Cleveland, Painesville & Eastern Railway is completed.

EAST LIVERPOOL, OHIO.—Franchises granted some time ago to Hairt & Smith, of Cleveland, and H. G. Folts, of Lisbon, for railway lines through Columbiana County, have expired through failure to commence work at the time agreed upon, and the ordinances will be repealed.

NEWARK, OHIO.—The Columbus, Buckeye Lake & Newark Traction Company has won a suit brought by citizens to restrain the building of its line into the town. To head off an injunction the company placed a large force of men at work and built the track through the contested territory.

LIMA, OHIO.—The promoters of the Lima, Delphos, Van Wert & Ft. Wayne Traction Company have secured nearly all right of way required. A franchise has been granted by the Allen County (Indiana) Commissioners, and franchises are now before the Councils of Delphos, Van Wert and Lima.

WEST JEFFERSON, OHIO.—The controversy between the village of West Jefferson and the Columbus, London & Springfield Railway is still unsettled. The Council granted another franchise which the company declined to accept. If the matter is not speedily settled, the line will be built around the town.

CLEVELAND, OHIO.—The Cleveland Construction Company, engineers for the Beloit, Delavan Lake & Jamesville Electric Railway has placed a contract with the Allis-Chalmers Company, for two Cross compound condensing engines to be installed at the power-house at Beloit, Wis. The road is owned by Cleveland people.

MANSFIELD, OHIO.—After being on paper for nearly five years, the Mansfield, Savanna & Wellington Railway Company has finally commenced construction work. The company has increased its capital stock from $100,000 to $1,500,000. T. Y. McCray is president, and T. Y. McCray, Jr., secretary of the company.

ASHTABULA, OHIO.—Goodrich & Tuttle, of Geneva, who hold a franchise along the highway for a line from Painesville to Ashtabula, claim they have secured financial backing, and the line will be built. The extension of the Cleveland, Painesville & Eastern Railway will be completed between these points next spring.

HAMILTON, OHIO.—The Hamilton, Eaton & Richmond Traction Company has been incorporated in Indiana and Ohio. The road will be built on private right of way from Hamilton to Richmond. The promoters are John J. Hall, Oliver Dillman, Warren D. Riddell and G. M. Hodges, of Hamilton, and J. S. Stewart and Charles Orr, of Cleveland.

CLEVELAND, OHIO.—The directors of the Cleveland City Railway Company have accepted the resignation of J. B. Hanna as secretary-treasurer of the company. John Ehrhard, at present assistant secretary of the company, will assume the duties of Mr. Hanna. A. E. Duty, heretofore assistant superintendent of the lines on the east side, has been made assistant superintendent of all the roads.

HAMILTON, OHIO.—Property owners have secured a temporary injunction against the Hamilton, Glendale & Cincinnati Railway Company known as the Millcreek Valley line. A motion filed by the defendants in the matter of purchase of consents was overruled, the Judge averring that each property owner had equal rights to recompense, and that the purchase of consents in itself was illegal.

CINCINNATI, OHIO.—The Cincinnati, Georgetown & Portsmouth Railroad, a steam road operating from Cincinnati to Georgetown, has been sold to the Comstock Brothers of Detroit. It will be changed to standard gauge and equipped with electricity and extended to Ripley, on the Ohio River, at once. Later it will be extended to Portsmouth, Ironton and other points in the river valley. The price paid for the property is said to have been $500,000.

CLEVELAND, OHIO.—The Cleveland promoters of the Toledo & Western Railway, now under construction into Michigan and Indiana, are planning to operate freight trains with electric locomotives after the pattern being experimented with in Germany. The road is being equipped with heavy rails and very high speed has already been attained. The equipment of the power-house at Sylvania is now being installed, and cars are being operated as far as Metamora.

EAST LIVERPOOL, OHIO.—G. C. Ingram, of East Liverpool, has applied for franchise in Wellsville and East Liverpool, and Chester, W. Va., for a line which he states will tap towns on both sides of the Ohio River extending from Wheeling to Steubenville, East Liverpool and connecting with Pittsburg. It is probable that the company is the Wheeling Traction Company, which is already building a line to Steubenville. E. W. Moore and H. Clark Ford, of Cleveland, are leading stockholders of the company.

CLEVELAND, OHIO.—The Toledo & Monroe Railway, which will be part of the line from Toledo to Detroit, is proving one of the best paying interurban properties in the country. It has been in operation only about three months and only three cars are operated, yet each car earns in the neighborhood of $80 per day. The run of 22 miles from Toledo to Monroe is made in 50 minutes and the fare is only 25 cents. It is said that the steam road has lost 90 per cent of its local business in consequence of this competition.

DAYTON, OHIO.—It is announced that the work of changing the tracks of the Dayton, Lebanon & Cincinnati Railway for electric traction is to be pushed to completion. It is the intention to operate electric cars during the day and steam freight trains at night. The road has recently been purchased by A. E. Appleyard, who is at the head of the syndicate which owns the Columbus, London & Springfield Railway and the Dayton, Springfield & Urbana Railway. It is probable that through cars will be operated over the three lines.

CLEVELAND, OHIO.—The officials of the Cleveland Electric Railway Company will soon place a contract for an elegant observation car. It is the intention to establish a regular schedule covering a route of 25 miles traversing the best streets and the leading points of interest about the city; both of the city lines being included in the itinerary. The car will be luxuriously furnished and a porter and guide will furnish information regarding the points of interest, besides providing for the comfort of passengers who will pay 25 cents for the ride.

CLEVELAND, OHIO.—The Windsor, Ont., street railway which has recently been purchased by the Everett-Moore syndicate, is to be improved and new rolling stock added. The power-house, which also furnishes light to the town, is to be improved. The Windsor, Sandwich & Amherstburg Railway also purchased by the syndicate, is to be operated from the Detroit power-house of the Detroit United Railways by means of cables stretched under the Detroit River. Both roads will be operated as a part of the Detroit District Railway Company, under the management of J. C. Hutchins.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company is breaking ground for another extension to its power-house. Contracts have just been closed for a duplication of the generating set now being installed. The outfit will consist of a 1600-kw General Electric generator direct connected to a cross compound Cooper-Corliss engine. One 250-hp Sterling boiler and one 250-hp Babcock & Wilcox boiler were ordered at the same time. The present boilers will be shifted so that part of the power station will be supplied from Sterling boilers and part by Babcock & Wilcox boilers.

COLUMBUS, OHIO.—The Columbus, Newark, Zanesville & Wheeling Electric Railway, of Newark, has been incorporated with $150,000 capital stock, by Joseph M. Ickes, D. C. Taylor, Chas. H. Geidel, W. O. Littick and John H. Black. The line will extend from Columbus to Bridgeport, opposite Wheeling, touching Newark, Zanesville, Cambridge and Barnesville, with a branch through Coshecton and Newcomerstown. The road is the result of the consolidation of the Newark, Zanesville & Coshocton Railway, with the interests of Messrs. Taylor and Black, who have secured franchises between Zanesville and Wheeling.

CLEVELAND, OHIO.—The absorption by the Everett-Moore syndicate of the so-called Appleyard roads in Ohio seems about to be consummated. According to a gentleman who is closely identified with the syndicate, there is under way a deal which is more gigantic than any yet attempted by these capitalists. It includes the absorption of roads which will place under one control a line from Cleveland to Columbus and Cincinnati, a line from Cincinnati to Toledo, with probably a line from Toledo to Columbus. This project is separate and distinct from the aims of the Pomeroy-Mandelbaum syndicate of Cleveland for lines touching the same points.

CLEVELAND, OHIO.—The Everett-Moore syndicate has arranged with eastern financiers to take $3,000,000 thirty-year bonds bearing interest at 4½ per cent on the Detroit & Toledo Shore Line. Previous to this transaction the syndicate closed the deal for the purchase of the Toledo & Monroe Railway and the line was consolidated with the Detroit & Toledo Shore Line. Immediately after, the two lines were transferred to the Detroit United Railway, and in the future will be operated as the Shore Line division of the Detroit District Railway, as the Michigan lines are to be known. Contrary to general impression, the Toledo & Monroe Railway has not been the property of the syndicate, but has been held by it under a lease.

CLEVELAND, OHIO.—M. J. Mandelbaum & Company, brokers and bankers, who handle the securities of the projects of the Pomeroy-Mandelbaum syndicate, will soon issue the stocks and bonds of the Little Miami Traction Company, the Western Ohio Railway Company, and the Richmond & Petersburg Railway Company. The securities of the Little Miami consist of $500,000 in bonds and the same amount in stock. The road is 19 miles in length and will be in operation about Jan. 1. The Richmond & Petersburg securities consist of $700,000 in bonds and $600,000 in stock. The road is 24 miles in length and will be in operation within two weeks. The Western Ohio deal consists of $2,500,000 in stock and the same amount in bonds; only $500,000 of the bonds being issued at the present time. The road will be in operation from Lima to Minister, 34 miles, in about 30 days.

CLEVELAND, OHIO.—The Central Illinois Traction Company, of which J. B. Hanna, formerly secretary-treasurer of the Cleveland City Railway Company, will probably be president, will be incorporated within a few days. Mr. Hanna will make his headquarters here, but will spend much of his time supervising the work in Illinois. The company will push construction work on the rights already secured, amounting to about 100 miles of track radiating from Springfield, and as fast as possible will secure right of way for an additional 100 miles of road. It is stated that the system will connect with the roads in the Fox River valley, running into Chicago, now building by a Cleveland syndicate, in which Messrs. Everett-Moore and Mahler are interested, and will extend as far south as East St. Louis, giving entrance to the Missouri metropolis.

OTTAWA, ONT.—Arrangements are reported to have been completed for the building of an electric railway system to connect the leading towns of the island of Cape Breton in the province of Nova Scotia.

OTTAWA, ONT.—The street railway, electric light, incandescent light and telephone companies of Toronto, Ont., have appealed against the increase of their municipal assessments that have just been revised and placed upon them. These increases appealed against are: Street Railway Company, $1,156,000, of which $700,000 is on its cars which have never before been assessed; Bell Telephone Company, $475,000 on poles, plant and wires; Electric Light Company, $129,000; and Incandescent Light Company, $165,000 on plant.

ALBANY, ORE.—The Albany Street Car Company has been incorporated, with a capital stock of $20,000, by J. R. Wyatt, N. V. Murray and J. H. Roberts.

PHILADELPHIA, PA.—Engineer W. S. Twining is engaged upon plans and specifications for a new power-house for the Union Traction Company. The building will be located on Wyoming Street, east of Broad Street.

BLOOMSBURG, PA.—Among the new lines of electric railway to be built in this region is one between Berwick and Nanticoke. The line will be twenty miles in length, connecting with the Columbia & Montour Electric Railway, at Berwick, and with the Wilkesbarre & Nanticoke road at Nanticoke, thus making a continuous line of electric roads between Bloomsburg, Wilkesbarre and Scranton. The officers of the company are: President, C. W. Miller; treasurer, L. E. Waller; secretary, C. C. Peacock; directors, L. E. Waller, C. C. Peacock, C. W. Miller, C. M. Creveling, C. H. Campbell and F. E. Miller.

EDGEFIELD, S. C.—A meeting of citizens of the Roper section has been held in the interest of the proposed electric railway from Edgefield to Augusta, Ga.

KNOXVILLE, TENN.—Ashley S. Johnson is said to be interested in a scheme to construct an electric railway from Knoxville, Tenn., to Sevierville, which will cost possibly $250,000.

HOUSTON, TEX.—The Houston Electric Street Railway Company, together with all its realty holdings, was disposed of at public sale on Oct. 1. The road was purchased by Owen D. Young, of Boston, the price paid being for the street railway $725,000 and for the real estate holdings of the company $67,500.

NORFOLK, VA.—The Norfolk & Atlantic Terminal Company has been fined $100 for violating the ordinance requiring the use of fenders. The trial grew out of the killing of a child by one of the company's cars.

SEATTLE, WASH.—The Seattle Central Railway Company, which expects to have its lines in Seattle, Wash., in operation before the close of October, has introduced a new type of combination electric car. It can be converted from an open to a closed car in three minutes.

NEW INDUSTRIAL COMPANIES.

ST. LOUIS, MO.—The Hill Electrical Manufacturing has been incorporated, with a capital of $25,000. Harry M. Hill holds 240 shares, W. P. Foster 5 shares and Morton Jordan 5 shares.

THE HUBBELL-GRIER ELECTRIC COMPANY, of New York City, has been incorporated; capital, $25,000. Directors: Harvey Hubbell and E. R. Grier, Bridgeport, Conn.; F. E. Laimbeer, New York City.

THE MORTIMER ELECTRIC COMPANY, of New York City, has been incorporated; capital, $10,000. Directors: Charles Mortimer, Jr., and G. P. Heinrich, of Brooklyn, and A. N. Clark, of South Norwalk, Conn.

THE COLUMBIA CONSTRUCTION COMPANY has been organized at Milwaukee, Wis., with a capital stock of $50,000. The incorporators are C. C. Smith, formerly connected with the Falk Manufacturing Company, and George P. Miller and W. H. Miller. The purpose of the new company, as outlined in the articles of incorporation, is to construct, promote and equip street and other railways, electric light and power plants, telephone and telegraph lines, and to operate street railways.

LEGAL.

EXTENSION TELEPHONES.—Where a telephone company having the exclusive privilege of operating lines in a city is prepared, at reasonable rates, to attach extension instruments for its subscribers, the Supreme Court of Rhode Island, in the case of Gardner vs. Providence Telephone Company holds that it may forbid the attachment of private extension instruments to its lines, and refuse the use of its lines and instruments to one who refuses to comply with such regulation.

OBITUARY.

C. WALTON SWOOPE, director of the electrical department of Spring Garden Institute of Philadelphia, died Oct. 7, after an illness of but a few days. Mr. Swoope was an occasional contributor to these columns, and for some years we printed annually an analysis from his pen of the distribution of subjects in the electrical patents of the preceding year. Of recent years he has prepared for the Philadelphia *Ledger* its column of "Industrial Science Notes." The General Index of the Electrical World (1883-96), issued in 1897, was compiled by Mr. Swoope. He was also the author of a book entitled, "Lessons in Practical Electricity," and, by a sad coincidence, the announcement of Mr. Swoope's death arrived in the same mail with a copy from the publisher of the second edition of this work. Mr. Swoope, who was 31 years of age, attended the University of Pennsylvania after graduating from a manual training school, and for a time was a student in the Schenectady shops of the General Electric Company. Accepting a position as instructor in the Spring Garden Institute, he labored with great energy, and finally succeeded in establishing an electrical department, giving complete laboratory instruction to classes of nearly 200 pupils. To provide instruments for the use of the pupils he established the Palmer Electrical Instrument Company, designing apparatus for the use of his own classes and for sale to other institutions.

PERSONAL.

MR. GEORGE WESTINGHOUSE sailed for Europe last week.

MR. J. B. HANNA, for many years secretary of the Cleveland City Railway Company, has resigned.

MR. CHAS. A. COFFIN, president of the General Electric Company, has returned from his recent trip to Europe.

MR. R. LESTER THAYER, of Peoria, Ill., was in Chicago this week, and reports a very favorable outlook for business.

DR. L. H. LAUDY lectured on the historical development of artificial illumination before the Cooper Union Chemical Society, at Havemeyer Hall, Columbia University, New York City, on Oct. 19.

MR. M. J. CARNEY, for many years general manager of the Central Union Telephone Company at Chicago, has been chosen vice-president of the company. He will continue to act as general manager.

MR. JOHN W. McNAMARA, second vice-president of the United Traction system of Albany, N. Y., has been elected president, in place of Mr. R. C. Pryn, who has become chairman of the board of directors.

MR. W. R. FLEMING, president of the Harrisburg Foundry & Machine Works, of Harrisburg, Pa., has just returned from an extended trip throughout Europe, made in the interests of his company with a view to pushing business in that part of the world.

PROF. GUSTAVE GILLON, of the University of Louvain, Belgium, who has been studying electrical conditions in this country, as well as the treatment of technical education here, has returned home greatly interested and impressed with what he has heard and seen.

MR. CHARLES F. MACK, for a number of years secretary of the Warren Electric Company of Sandusky, Ohio, has resigned to accept a position with the Kilby Manufacturing Company, of Cleveland, manufacturer of beet sugar machinery and general lines of heavy work.

MR. C. H. WILMERDING, the consulting engineer of Chicago, and a past president of the National Electric Light Association, has recently issued an interesting pamphlet descriptive of the large electrical plant installed under his direction at the Hannibal shops of the Chicago, Burlington & Quincy Railroad.

MR. MARK DAVIS, well known throughout the independent telephone field as general manager of the Cuyahoga Telephone Company, of Cleveland, has resigned, to accept an important position with the Canada Life Assurance Company, with which he was formerly identified. During the two years of his management of the Cuyahoga Company, the Cleveland exchange has grown from a small beginning to be the largest exchange in the independent field.

MR. NIKOLA TESLA is the subject of an article by Mr. Eliot Lord, in the November *Junior Munsey Magazine*. An interesting review is given of Mr. Tesla's inventions, ideas and personality. As to his experimental work: "Time is with him an infinite stretch. * * * In writing of the probable development of the use of aluminum, for example, he used the word "soon" in a sense so differing from the ordinary that his statement was ridiculed by a leading technical journal."

MR. F. E. DRAKE, director of machinery and electricity for the United States at the Paris Exposition, has for some months been in complete charge of the works of the Union Elektricitaats Gesellschaft at Berlin. It is now understood that upon the invitation of the directors he has agreed to stay until next spring, and that he will carry out some important changes during the winter. The company manufactures on an enormous scale and turns out a remarkably wide range of apparatus.

MR. T. JEFFERSON COOLIDGE, late Minister to France, has given a fund of $50,000 to the Jefferson Physical Laboratory of Harvard University for physical research. The income is to be expended at the discretion of the director, Prof. John Trowbridge. Among the terms of the gift is the following: The income of this fund shall be used primarily for laboratory expenses of original investigations by members of the laboratory staff; but the director, at his discretion, may award therefrom an honorarium, of not more than $500 per annum, for the private use of any person who—although receiving no salary from the university—may wish to carry on original investigations under his direction at the Jefferson Physical Laboratory.

BUFFALO PERSONALS.—The following names are of recent registry at the booth of ELECTRICAL WORLD AND ENGINEER, Electricity Building, Pan-American Exposition: J. L. Putnam, Clark Automatic Telephone & Switchboard Company, Providence, R. I.; B. G. Stauffer, treasurer G. C. Towle Manufacturing Company, Lancaster, Pa.; C. L. Edgar, Boston, Mass.; Bert C. Benham, Muscatine, Ia.; E. Reubel, St. Louis, Mo.; N. Lazarnick, New York City; Max Loewenthal, New York; W. B. Hale, Western Electric Company, Chicago; Horacio Valdis, Brussels, Belgium; Harry Rodrick, East Las Vegas, New Mexico; Geo. Brady, Chicago, Ill.; H. F. Nichols, Adelaide, South Australia; W. M. Barnes, Philadelphia, Pa.; C. A. Vandersyde, Chicago, Ill.; James W. Queaby, Chicago, Ill.; C. S. Chamberlain, Brooklyn, N. Y.; Thos. D. Macrae, Buffalo, N. Y.; Theshie Shaw, Genoa, N. Y.; J. E. Farrar, Rochester, Mich.; W. M. Sharp, Rochester, Mich.; Cecil Hodgson, Manchaster, Eng.; F. A. Vaughn, Milwaukee, Wis.; W. M. Barnes, Philadelphia, Pa.; James Walker, Lansing, Mich.; W. C. Harris, Philadelphia, Pa.; Fred. Hazelbauer, Corning, N. Y.; M. J. Vannett, New York, N. Y.; Mrs. R. M. Vannett, New York, N. Y.; E. R. Larter, Youngstown, Ohio; F. L. Rogers, Perry, Ia.; Arthur Merkhofer, Cincinnati, Ohio; Fred. C. Murphy, Buffalo, N. Y.; J. F. Doherty, Bones, Cuba; Thos. Chambers, New York, N. Y.; T. S. Coysvill, Attica, N. Y.; W. T. Bushman, Buffalo, N. Y.; J. L. Harper, Buffalo, N. Y.; C. S. Russel, Pittsburg, Pa.; H. W. Locklin, Lyndonville, Vt.; Henry W. Hall, Titusville, Pa.; M. H. Rogers, East Aurora, N. Y.; Geo. S. Davis, Cleveland, Ohio; Thos. P. Thompson, Norfolk, Va.; Alex. S. Hedman, Brooklyn, N. Y.; R. H. Moore, Buffalo, N. Y.; H. E. Hatchunch, Grand Rapids, Mich.; H. E. Greenwood, Newark, N. J.; Edward C. Ruth, Mt. Vernon, N. Y.; Ezra Fawcett, Alliance, Ohio; Chas. F. Schnitz, Hartford, Conn.; F. C. Corley, Cambridge, Mass.; P. S. Graves, Pittsburg, Pa.

Trade Notes.

THE PITTSBURG TRANSFORMER COMPANY, Pittsburg, Pa., has just issued Bulletin No. 7, which has for its subject three-wire secondary distribution. It contains illustrations of Pittsburg transformers.

SEVENTY-FIVE THOUSAND.—It is given out on the authority of the Electric Appliance Company, Chicago, that there are over seventy-five thousand Adams-Bagnall now in use in the United States and Canada.

"LIGHT READING."—This is the title of a pamphlet just issued by the New York & Ohio Company, Warren, Ohio, giving some facts regarding Packard incandescent lamps. A good deal of information on the subject of good lamps is given.

THE FAIRBANKS COMPANY, Philadelphia, known throughout the world and with branch stores in all principal cities, has just taken the agency for the Cross oil filters and Burt exhaust heads, manufactured by the Burt Manufacturing Company, of Akron, Ohio.

THE ROSS ANNUNCIATOR.—The Electric Gas Lighting Company, 195 Devonshire Street, Boston, is sending out a private mailing card containing a fine engraving of the Ross annunciator with "Colonial" case, representing the instrument as it appears on the wall.

TRI-LIGHT.—The Pinckard Tri-Light is the subject of a little pamphlet issued by E. B. Latham & Company, 39 Vesey Street, New York. This lamp gives three different degrees of candle-power, by simply turning the socket key, which varies the connections of the lamp filaments.

UNITED TELPHERAGE COMPANY, 20 Broad Street, New York City, has just issued Circular No. 17. The first page illustrates and describes its center-bearing telphers. The second page shows side-bearing telpher with an electric hoist. Methods of line construction are freely and admirably illustrated also.

SMALL TOOLS.—The Pratt & Whitney Company, Hartford, Conn., has issued a catalogue of its small tools, standards and gauges. This catalogue is very completely illustrated and contains 152 pages, including a complete index, besides various mathematical tables which will save labor in calculations. The illustrations are very artistic and the catalogue as a whole is an excellent piece of work.

THE CENTRAL ELECTRIC COMPANY, of Chicago, is calling attention to the "Ideal" dry battery. This battery is rapidly becoming a favorite in telephone work, and the Central Company is expecting the demand to increase rapidly as the battery has now stood the test of practical work. This company wishes also to inform its customers that it will be pleased to quote prices on batteries of all makes, both fluid and dry.

STURTEVANT MOTORS, DYNAMOS, ETC.—The latest addition to the attractive literature produced by the B. F. Sturtevant Company, Boston, Mass., is a 50-page catalogue (No. 117) on the subject of Sturtevant electric motors, generators and generating sets. The illustrations show motors of different styles for various purposes. The pamphlet is gotten up in the Sturtevant Company's usual attractive manner and describes the apparatus concisely.

COMBUSTION APPARATUS.—Messrs. Baker & Company, the well known platinum refiners, of Newark, N. J., have issued a neat little pamphlet describing Tucker's combustion apparatus for determining with accuracy the volatile ingredients in organic matter. It may also be used to great advantage for the dry distillation of substances and for making qualitative determinations of the volatile ingredients of ash obtained from various materials, as well as of other matter than ash. The apparatus is carefully described and clearly illustrated.

ECONOMIZERS.—Green's fuel economizer is completely and very artistically illustrated in a handsome catalogue just issued by the Green Fuel Economizer Company, Matteawan, N. Y. Steam users will find a good deal of valuable information on this important subject in this pamphlet, and apart from its practical value the pamphlet is a model of artistic execution. The half-tones used are of the finest quality and very clearly illustrate the device in actual operation. Various curves are given showing the saving effected by the use of Green's economizer.

THE SIGNALOID CHEMICAL WORKS, formerly the Phenix Chemical Works, have removed from Brooklyn to Jersey City. The new factory address is 167-169 Clendenny Avenue, where they have larger facilities for the manufacture of "Signaloid," a lamp coloring and frosting compound for incandescent lamps and other decorative glass work. The name has been changed as given in order to more clearly indicate their work by making as a part of their title the brand of coloring compound which has become widely and very favorably known. The office of the company is 382 Bergen Avenue, Jersey City, where Mr. Greeder will cheerfully show specimens of the compound and give any information concerning it.

PROTECTION OF LIFE AND PROPERTY.—Those interested in devices for the protection of life and property should procure from the Central Electric Company of Chicago, bulletins on D. & W. material. These devices include junction boxes, street car and power motor cutouts, transformer cutouts, car heater cutouts, subway boxes, feeder blocks, service switches and cutouts for lighting, telephone and fire alarm systems, all of which are equipped with D. & W. non-arcing fuses. These enclosed fuses are highly recommended by the National Board of Fire Underwriters, as they overcome the flash of the old style open fuses, and therefore lessen fire risk to a minimum. The Central Electric Company will be pleased to furnish full information regarding this material on application.

CHARLES H. BESLY & COMPANY, 10-12 N. Canal Street, Chicago, Ill., report their general business very good. They are especially busy in the tap and grinder departments of their factory at Beloit, Wis. They made a carload shipment to Chicago of Gardner grinders and Besly band machines in September, and expect to make another carload shipment of these same machines in October. These machines are being shipped to all parts of the United States and Europe. New catalogues of Gardner grinders and Besly band machines, and other specialties of their manufacture will be mailed free upon application. Many orders are being received from jobbers for their parallel clamps, Bonanza, Badger and Perfection oil cups, as well as for their celebrated Helmet oil. They consider the outlook for future business very bright.

TEACHING LANGUAGES BY PHONOGRAPH.—We have received from the International Correspondence Schools, Scranton, Pa., a handsome brochure in two colors, announcing that to their already large curricula of one hundred courses they have added the studies of French, German, and Spanish. Instruction in these subjects by the International system is conducted almost entirely

by means of an Edison standard phonograph and the Schools' specially prepared instruction papers. The lessons are sent out in the shape of records and pamphlets—the one a key to the other—each record being a master record bearing the voice of the native instructor. After studying his lesson, both from the pamphlet and the record, until he has thoroughly mastered it, the student recites into the phonograph, using one of the wax cylinders furnished him, and returns it to the schools. These examination records show exactly the student's progress—whether he is acquiring ease, fluency, correct articulation, distinct utterance, etc. The records are carefully examined by his instructor, who writes the student letters of criticism and suggestion. Thus the work goes on lesson by lesson to the end. It is specially worthy of note that the records sent the student are original or "master" records; that is, they contain the voice of the native instructor directly transmitted. Taken in connection with the Schools' instruction papers, the student can quickly and easily acquire a thorough working knowledge of one or more of the modern languages. The new courses have already met with great favor, and will no doubt do much toward swelling the Schools' enrollment, which is already over 325,000. Interested parties should send to the International Correspondence Schools for the free circular on modern languages, which contains a full account of how they teach these subjects by correspondence.

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED OCT. 15, 1901.
[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

684,407. ELECTRIC ARC LAMP; Hugo Bremer, Weheim, Germany. App. filed Nov. 2, 1900. (See Current News and Notes.)

684,408. TROLLEY ATTACHMENT; T. J. Burke, New Orleans, La. App. filed July 1, 1901. To enable one trolley to pass another on the same wire, one of them carries a bridge passing underneath it, upon which the second wheel runs, in passing.

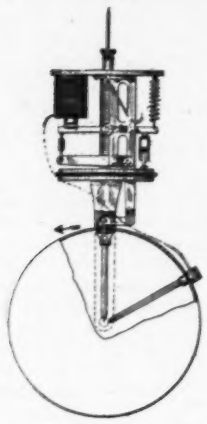
684,415. QUADRUPLEX TELEGRAPHY; C. E. Diehl, Harrisburg, Pa. App. filed Feb. 25, 1901. In a system wherein signals are sent by strong, weak, positive and negative currents, means are provided for avoiding the false signals liable to occur when a current impulse sent to operate the neutral relay has its polarity reversed by the operation of the transmitter to vary the polarity of such impulse.

684,440. SIGNAL TELEGRAPH; E. Lavens and E. J. Lavens, Brooklyn, N. Y. App. filed Jan. 7, 1901. Two identical instruments electrically connected and each adapted to transmit an order which will be visibly and audibly indicated by the opposite instrument.

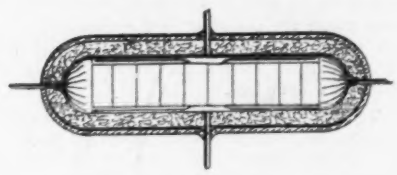
684,459. ELECTRIC HEATER; E. F. Porter, Boston, Mass. App. filed Jan. 29, 1898. The blades of an electric fan are electrically heated to heat the air against which they strike.

684,467. WIRELESS TELEGRAPHY; H. Shoemaker, Philadelphia, Pa. App. filed Feb. 12, 1901. A self-restoring coherer, comprising a central tube and an outer tube, the former containing a sheet of foil having transverse and longitudinal slits in it.

684,506. TELEPHONE RELAY; Bela Gati, Temesvar, Austria-Hungary. App. filed March 22, 1900. (See Current News and Notes.)



684,619.—Electric Arc Lamp.



684,467.—Wireless Telegraphy.

684,541. SYSTEM OF TESTING COILS; R. W. Conant, Boston, Mass. App. filed Jan. 7, 1901. Self-inductive coils and resistance coils in circuit with portable terminals; a source of current supply and means for indicating a difference in the self-inductive capacity of the two sides of the circuit.

684,579. MEANS FOR OPERATING ELECTRICAL MACHINES SYNCHRONOUSLY; C. J. A. Machalke, Charlottenburg, Germany. App. filed Dec. 31, 1897. In an alternating current power-circuit, a plurality of armatures each provided with an alternating current winding, field windings for each of said armatures deriving their current from any suitable source of alternating current independently of the armatures, and leads for electrically interconnecting the said armatures for the purpose of producing equalizing-currents therein when the armatures do not occupy corresponding relative positions.

684,596. ELECTRIC RAILWAY; B. Bidwell, Philadelphia, Pa. App. filed Aug. 14, 1884. (See Current News and Notes.)

684,600. ELECTRIC RAIL BOND; I. B. Chantler, Sewickley, Pa. App. filed Jan. 16, 1901. Spiral springs encircle the fish-plate bolts and press against the rail and the plates to maintain the connection.

684,601. TELEPHONE APPARATUS AND SYSTEM; Frank B. Cook, Chicago, Ill. App. filed April 13, 1898. (See page 683.)

684,602. APPARATUS FOR TELEPHONE SYSTEMS; Frank B. Cook, Chicago, Ill. App. filed April 17, 1899. (See page 683.)

684,604. CONDUIT PIPE; A. S. Dixon, Los Angeles, Calif. App. filed March 29, 1901. The pipe is built up of alternate layers of paper and asphaltum composition.

684,609. CONTROLLING SYSTEM FOR RAILWAY VEHICLES; E. R. Hill, Wilkinsburg, Pa. App. filed Sept. 20, 1900. In a multiple unit system, means are provided for stopping the controllers at the full series position, and at the full multiple position, independently of the main controlling switch.

684,612. SYSTEM OF ELECTRICAL DISTRIBUTION; C. J. A. Michalke, Charlottenburg, Germany. App. filed Dec. 31, 1897. A dynamo provided with two sets of windings, one receiving current from an alternating source; a transformer provided with fixed coils interposed between the second set of windings of the dynamo and the source of current and means whereby the relative connection between the transformer and the second set of windings are varied.

684,615. TELEPHONE CALL BELL APPARATUS; Wm. S. Paca, Erie, Pa. App. filed Dec. 26, 1900. (See page 683.)

684,619. ELECTRIC ARC LAMP; C. M. Shafer, McDonald, Pa. App. filed June 26, 1901. The carbons stand at an angle to each other, one being fixed to the globe, and the latter is moved by the lamp mechanism, so that the carbons will approach or recede.

684,628. ELECTRIC RESISTANCE; W. A. Carrell, West Homestead, Pa. App. filed June 21, 1901. Details.

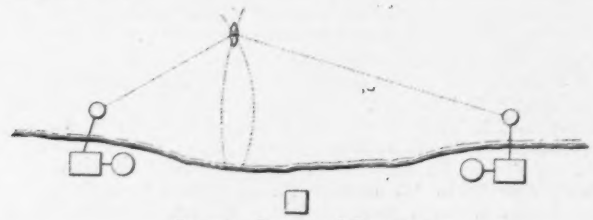
684,631. PIPE COUPLING; H. R. Dean, Brooklyn, N. Y. App. filed April 30, 1901. Details.

684,641. INSULATOR FOR STORAGE BATTERY PLATES; Chas. S. Kaufmann, Chicago, Ill. App. filed Jan. 7, 1901. (See Current News and Notes.)

684,642. PLATE FOR STORAGE BATTERIES; Chas. S. Kaufmann, Chicago, Ill. App. filed Jan. 9, 1901. (See Current News and Notes.)

684,643. PLATE HOLDER FOR ELECTRIC STORAGE BATTERIES; Chas. S. Kauffmann, Chicago, Ill. App. filed Jan. 20, 1901. (See Current News and Notes.)

684,695. PROCESS OF ELECTRICALLY CONNECTING PLATINUM WIRES OR SHEETS WITH NON-METALLIC BODIES; Richard Kuch, Hanau, Germany. App. filed Oct. 15, 1901. The process consists in loosely connecting platinum wire to a non-metallic fine smeltable oxide, smearing the end of this body with a solution of platinum or platinum salts, heating the same to a glow to form a metallic connection, then strengthening by a small amount of easy smelting metal which can be absorbed or alloyed with this sponge.



684,706.—System of Signaling.

684,697. STORAGE BATTERY FOR BOATS; Robt. McA. Lloyd, New York, N. Y. App. filed June 14, 1900. (See Current News and Notes.)

684,699. STORAGE BATTERY; Robt. McA. Lloyd, New York, N. Y. App. filed Feb. 15, 1901. (See Current News and Notes.)

684,700. STORAGE BATTERY; Robt. McA. Lloyd, New York, N. Y. App. filed Feb. 15, 1901. (See Current News and Notes.)

684,706. SYSTEM OF SIGNALING; A. J. Mundy, Boston, Mass. App. filed April 5, 1901. To determine the distance between two points across water, a wireless telegraph signal and a sound signal are simultaneously sent from one point; the difference in the time of their receipt at the second point determines the distance between the two points.

684,725. MEANS FOR CONTROLLING ENERGY DELIVERED TO TRANSLATING DEVICES; J. Sachs, Hartford, Conn. App. filed March 9, 1900. For self-propelling vehicles, an engine, a dynamo, a motor and an automatic controlling device are used. By means of the controller, extra current is supplied to the motor by the dynamo, when necessary to exert more power, but such extra current is supplied at a lower electromotive force, which conequently drives the motor at a slower speed. The result is a constant output by the prime motor and a variable output at variable speed by the translating motor.

684,732. COUPLING FOR SECTIONAL THREADING RODS; R. H. Villard, Rochester, N. Y. App. filed Feb. 27, 1901. Details.

684,736. BUSHING; A. J. Wurts, Pittsburg, Pa. App. filed March 23, 1901. A wire passing through a hole in any body is surrounded by a bushing fixed to it, so that movements of the wire in the orifice will not chafe the insulation of the wire.